

FINAL REPORT

Vol. I

JUNE 1972



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AIR PRODUCTS AND CHEMICALS, INC.
ALLENTOWN, PENNSYLVANIA 18105

Prepared for

AEROSPACE SAFETY RESEARCH AND DATA INSTITUTE
LEWIS RESEARCH CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CLEVELAND, OHIO 44135

Under

NASA Contract NAS3-15083
Paul M. Ordin, Program Manager

Final Report

Volume I of Four Volumes

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ACKNOWLEDGMENTS

This investigation was initiated by Mr. I. Irving Pinkel, Director Aerospace Safety Research and Data Institute, NASA - Lewis Research Center, Cleveland, Ohio. The work was performed by Air Products and Chemicals, Inc., Allentown, Pennsylvania, under Contract No. NAS3-15083. Dr. A. Lapin was the Project Manager for Air Products and Chemicals, Inc. and Mr. P. M. Ordin was Program Manager for the Lewis Research Center.

This report is the result of the joint effort of a corporate wide team: a steering committee comprising Mr. W. L. Ball and Drs. A. Lapin and C. McKinley and about 15 additional senior personnel representing different departments and divisions. The efforts of Mrs. A. M. Powell and Miss S. L. Price in the preparation of the General Index, and of Mrs. K. F. Quay in the typing and preparation of the final report are appreciated. Special acknowledgment is made of the very significant contributions of Mssrs. I. Iverson, F. K. Kitson, H. H. Master, and W. W. Schmoyer.

The continual review and constructive criticism of Mssrs. P. M. Ordin, and G. Mandel, NASA - Lewis, and of Mr. W. L. Ball and Dr. C. McKinley, Air Products and Chemicals, Inc. are gratefully acknowledged.



ABSTRACT

A thorough and detailed study of Air Products and Chemicals, Inc. and Air Products Ltd. practices in the design and use of equipment in oxygen service, was performed. The report includes Liquid and Gaseous Oxygen Safety Review information covering: Material Compatibility, Operational Hazards, Maintenance Programs, Systems Emergencies, and Accident/Incident Investigations and Reports, and a set of references. Areas requiring further research and development for systems involving exposure to oxygen environment have been identified. An index to the Liquid and Gaseous Safety Review Data Forms and a General Index have been included to allow for easy retrieval of the reported information.



INTRODUCTION

The NASA Aerospace Safety Research and Data Institute (ASRDI) is responsible for providing NASA and its contractors with technical information and consultation on safety problems. To assist in this effort, a thorough and detailed study of Air Products and Chemicals, Inc. (APCI) and Air Products Ltd. (APL) practices in the design and use of equipment in oxygen service, has been performed in accordance with the terms of NASA Contract NAS3-15083.

The purpose of this study was to provide ASRDI with some of the industrial information needed for their oxygen safety review program which has the following objectives:

- 1. Providing early recommendations to improve NASA's oxygen handling by comparing NASA and contractor oxygen systems design, inspection, operation, maintenance and emergency procedures with those practiced in industry, universities and other government establishments. These systems include those used on space vehicles, aircraft, test and service facilities, surface vehicles, and disposal systems.
- 2. Assessing the vulnerability of NASA and contractor oxygen equipment to failure from a variety of sources so that hazards may be defined and remedial measured formulated.
- 3. Filling gaps in knowledge on oxygen handling through analysis and research in order to provide a better data base for the design of oxygen system and associated safety equipment, and for the formulation of meaningful tests, inspections, and emergency procedures.
- 4. Issuing criteria and standards on all aspects of oxygen handling and disposal.
- 5. Providing insight into the key processes that control the performance of oxygen systems and their components as an aid to design and operation, particularly under off-design or emergency conditions.

Specific questions concerning oxygen safety were included in the contract in the form of an Oxygen Safety Review Data Form and Check List. These provided guidelines as to the type of information desired and included a format for identifying referenced documents. A brief summary of each main heading of the NASA Safety Review Check List includes the following:

I. Material Compatibility

A. List of materials used or contained in liquid and gaseous oxygen systems.



The materials used in oxygen systems, whether in direct contact with oxygen, or exposed to oxygen rich air as a result of leaks or accidents are individually considered under this heading. Methods and tests used to evaluate the compatibility of the materials in an oxygen environment are described. References are listed whenever applicable. Allowable oxygen environments are specified for each one of the materials listed.

B. Compatibility Checks

The compatibility considerations of materials in the oxygen systems are discussed and information on how the areas of possible concern in oxygen systems are handled is provided. Design criteria, cleaning procedures and quality control methods are covered in detail.

II. Operational Hazards

Guidelines, codes, regulations and special procedures used in the design, installation, fabrication, testing and operations for protection against hazards involved with production, transportation, storage and system handling of oxygen are presented with a list of related references.

III. Maintenance Programs

The Company practices employed in the oxygen systems maintenance programs to minimize both accident probabilities and consequences of accidents and/or incidents are described. Appropriate sections of the Operations Department and Industrial Gas Division Operating Manuals are discussed.

IV. Systems Emergencies

The practices employed to handle emergencies are spelled out in some detail. Training, warning, and protection of personnel and equipment are discussed.

V. Accident/Incident Investigations and Reports

A review is made of accidents involving oxygen which occurred in the industry in general, and in the company in particular. Accident reports are presented whenever available.

An Air Products and Chemicals, Inc. steering Committee consisting of:

W. L. Ball Corporate Safety Director

A. Lapin Project Manager

C. McKinley Cryogenic Systems Division - R&D Director

reviewed the information generated by a task force of 15 senior engineers and supervisory personnel who have been instrumental in shaping the company safety policies throughout the years and who represented the following Divisions and Departments of the Company:

Air Products Limited

Corporate Safety Department

Cryogenic Systems Division:

Central Design Engineering Department
Electro-Machinery Department
Operations Department
Project Engineering Department
Research and Development Department

Industrial Gas Division
Engineering Department

Industrial Products Division

Quality Control Department

Metallurgical Services Division

Gas Equipment Department

This review was supplemented by interviews, discussions, and visits to several APCI and APL air separation plants and manufacturing facilities both in the U.S. and Europe. This information was then summarized and used in the preparation of the Oxygen Safety Review Forms. In most instances, an individual Form was used to cover the practices of one department, thus resulting in some duplication when two different departments reported on the same type of activity. For example, both APCI and APL's cleaning procedures and practices are separately covered in Forms IBlc-1 and IBlc-2 respectively. In general there was no attempt to identify differences existing between the practices of the different departments, since this was not within the scope of the program.

It should be noted that the Air Products material covers an experience period of over 15 years, therefore some contradictions may exist between new and old documents in particular if they originated in different departments. Where such differences exist through evolutionary changes in practice, the latest Air Products document is controlling.

It is interesting to note that while the Corporate and Divisional Safety Criteria are generally followed throughout the company, local conditions sometimes require special treatment as determined by local managers. For example, the Plant Manager at the Hettingen Plant in Germany, instituted a system of valve locks and keys to insure that liquid oxygen is delivered to liquid oxygen tankers only, thus eliminating the possibility of loading the wrong product in the liquid tanker. Differences in procedures between plants are also necessitated by the fact that in some areas the truck drivers are APCI employees, while in others they belong to other organizations under contract to APCI. In addition some plants service only APCI tankers while



others service APCI tankers and others as well. Similarly some customer installations require different or additional precautions as determined by the specifics of the locations, usage, etc. Safety Criteria in these cases are determined by the Departments involved in conjunction with the Safety Department.

It seems that assuring safety in a large organization in which a large number of special local conditions require modifications to the general safety criteria, could best be achieved by the following two-phase approach:

1. Criteria Establishment

Safety criteria and philosophy are established by the Safety Department with strong technical support from the Research and Development Department. These criteria will identify material compatibility, design concepts, contaminant types and levels acceptable to specific applications, systems evaluations, and other significant factors.

2. Criteria Implementation

Implementation of safety criteria is the responsibility of all levels of supervision and all personnel. This is achieved by education and training in such a way, that safety implementation becomes second nature. The objective is clear understanding of general philosophy and criteria, so that implementation of safety is achieved, and that changes necessary to accommodate specific local conditions can be made by knowledgeable personnel without endangering the desired goals.



ORGANIZATION OF REPORT

The report consists of the following parts:

- 1. Recommendations for Research and Development
- 2. Index to Liquid and Gaseous Safety Review Data Forms

This index lists the Review Data Forms in numerical sequence. It identifies each form by number, title, date and number of pages.

3. Liquid and Gaseous Oxygen Safety Reveiw Data Forms

This part of the report closely follows the NASA Oxygen Safety Review Check List and Review Data Form (Attachments I and II of NASA Contract No. NAS3-15083). In fact the forms numbering system corresponds to the NASA Documents numbering system. Thus, Form IA2a-7 is the 7th APCI Form with information requested in paragraph IA2a of the NASA Review Check List which relates to the Material Compatibility of Sealants and Threading Compounds. The organization of the form itself is in close conformity with the suggested NASA Review Data Form. The APCI Data Review Form includes only those sections of the NASA Form which apply to the particular subject.

4. General Index

The General Index covers all Documents referred to in the Data Review Forms, the Data Review Forms themselves, and an additional number of documents related to the subject of oxygen, oxygen handling and safety. The General Index consists of five sections:

- a. Numerical Section: All documents are listed in numerical sequence, starting from 990000010. (The 9th digit, which is always a zero, except in one case 99000261A, should be ignored).
- b. Authors Section: All documents are listed alphabetically by each one of the authors.
- c. Corporate Titles Section: All documents are reported alphabetically by the name of the Corporation or Institution which originated the document. For example, a paper authored by a member of Lehigh University, will appear under Lehigh University. Similarly, the reports by C. F. Key of NASA will appear with the NASA grouping.
- d. Subjects Section: All documents are listed alphabetically by each one of the main words of the document title, and by key words which were added, whenever desirable.
- e. Source Section: All documents are listed in alphabetical order in accordance to their source identification such as AIChE-CEP-TECH-MANUAL for an American Institute of Chemical Engineer publication or DMIC-MEMO-163, for the Battelle Memorial Institute Report identified as Publication DMIC-MEMO-163.



The General Index arrangement thus allows information retrieval from several bases. For example, a lubricant covered by this study, can be found under L, with all other lubricants, or by looking up its specific name, such as Krytox. All documents referring to this item will be identified and could then be found in the Reference Section of the report, by looking up the Document Numbers.

5. References

This section contains all documents included in the General Index, in a numerical sequence. The APCI documents are reproduced in full and are released for general distribution and availability with the exception of the following documents which are not released and are not available for general distribution:

99000234 99000247 99000258 99000308 99000388 99000392 99000393 99000394 99000395

Only one page is included in the Reference Section for each non APCI document, with sufficient information to provide full identification and retrieval.

A number of additional documents have been included in this section even though they were not referred to in the Review Forms. These documents are related to oxygen safety and could be of interest to the reader. Some of them are listed below:

- APCI Documents #9900007 and 99000017 provide the properties of gaseous and liquid oxygen.
- APCI Documents #99000060 through 99000065 and 99000069 describe Research and Development work performed in the early 60's.
- APCI Documents #99000306, 99000312 and 99000313 cover recent work using the 0_2 Index as one factor in determining acceptability of materials for oxygen service.
- APCI Document #99000340 briefly describes APCI procedure for the determination of material compatibility with oxygen.
- APCI Document #99000595 is an APCI report on the experimental burning of metals in oxygen atmosphere and includes an appendix containing the abstracts of 43 papers on the ignition of metals.



RECOMMENDATIONS FOR RESEARCH AND DEVELOPMENT

In order to determine acceptance of materials for oxygen service and the safety of the system itself, it is essential to have material properties and criteria for acceptability as follows:

1. Material Properties as a Function of Oxygen Concentration and Pressure

Some or all of the following information is required to evaluate a material for oxygen service.

- a. Material identification
- b. Ignition temperature
- c. Ignition energy
- d. Oxygen index
- e. Calorimetric heat values
- f. Adsorption capacity for oxygen
- g. Autoignition temperature
- h. High pressure compatibility
- i. Behavior under impact conditions

Literature should be carefully reviewed so that available information is evaluated and used. Laboratory work may be needed to supplement available information.

2. Systems Behavior

In any industrial hazard situation, the amount of ignition energy to ignite a material in oxygen or oxygen rich environment is importantly related to the material and intensity of the energy input. It is also related in an extremely important fashion to the entire system. The dynamics of the ignition process is also a function of the entire system. It is therefore necessary to carefully examine and evaluate each individual component as



well as the subsystems and total system for behavior in an oxygen atmosphere as a function of oxygen concentration, pressure, and temperature.

3. Criteria for Acceptability

Criteria will have to be established for the acceptability of materials in oxygen service based on the material properties and examination of the system or subsystem, in which the materials are used. These criteria should be based on the following:

- a. Acceptance of materials per se.
- b. Limits on the quantity of materials in the specific system being examined.
- c. Level and type of allowable contamination for the application.
- d. Limits of temperature, pressure and oxygen concentrations.
- e. Inspection and quality control procedures.

Review of the available information regarding oxygen compatibility of materials indicates that additional information in the following areas may be required for the complete safety evaluation of a specific system.

1. Material Properties

Material properties needed for oxygen compatibility evaluation are usually available in the technical literature. However, this information is sparse or lacking completely in the case of new materials and for high pressure (3,000-10,000 psi) applications. In these instances, it will be necessary to acquire the needed properties by experimental determination.

2. Significant Testing

A number of tests are being used to determine material compatibility in the presence of oxygen. However, these tests are usually not closely related to the main characteristics of the system in which these materials are used. For example, impact testing is a widely used criterion for material acceptance, even when impact is not a factor of the specific application under consideration. The amount of energy needed to ignite a material is importantly related to the material itself, its physical dimensions, to the character and intensity of the energy input, and in an extremely important fashion to the entire system. For example, massive metal sections clearly ignite less readily than do powders, wires, ribbons, and small sections. Therefore it is essential to devise appropriate tests which incorporate the potential hazards of the system, such as sparks, friction, or gas compression and the correct size of the test specimen. The results of these tests will be significant and will provide a more dependable basis for material selection for the contemplated service.

3. Effect of Contaminants on the Materials Suitability

In general, the bulk of the work in the area of oxygen compatibility is performed with meticulously clean materials. Contaminants are studied by themselves, independently of the materials that they would contaminate.



It is believed that some materials may be more detrimentally affected than others by the presence of contaminants. It is therefore necessary to consider the complete system in order to determine the possible sources, types and quantities of contaminants, so that appropriate testing conditions may be determined. These tests will help establish tolerable contamination levels for the system.

4. System Testing

Complete systems should be carefully examined to determine their oxygen compatibility. Even if each individual component is acceptable on its own, synergistic effects may render an assembly of these components unacceptable. Therefore, systems and subsystems may have to be tested before a decision can be made regarding oxygen suitability. The effect of contamination in this particular case is extremely important since reactions or chain reactions may be triggered by contamination with a resulting ignition and combustion of materials which would not otherwise have been ignited.

5. Criteria for Compatibility

Present criteria for oxygen compatibility are often based on one or two types of tests even when they are not closely related to the intended applications. It is recommended that the information obtained from new research programs be used to reexamine the present criteria to determine their validity. These programs should also provide the basis for new criteria which will integrate all available factors related to the compatibility of materials and to the system itself such as: oxygen phase, concentration, temperature and pressure, materials properties, systems characteristics, potential hazards and degree of exposure to life and equipment in case of a failure. It is envisioned that an all inclusive "System Compatibility Index" or "System Safety Factor" could be developed by applying an empirical coefficient to each pertinent factor, which would apply to all types of oxygen systems: high or low pressure applications, liquid or gas phase environment, simple or complex. This "System Compatibility Index" or "System Safety Factor" will provide a numerical system which will indicate the degree of safety of the system being examined and will enable sound comparisons between competing schemes.

The research and development programs that are needed to provide the required information for a complete safety evaluation of systems involving oxygen, should consist of a number of limited scope parts dealing with specific systems and/or subsystems. In general each part of the program should provide answers to the following questions for the system being studied:

- 1. Assessment of realistic hazards as opposed to laboratory hazards.
- 2. Criteria for cleaning and frequency of solvent washing.
- 3. Effect of rust and foreign particles in the oxygen streams of the system.

- 4. Maximum allowable level of contamination.
- 5. Relation between allowable level of contaminants and cleanliness requirements.
- 6. Frequency of equipment inspection.
- 7. Criteria for lubricant selection for air and oxygen service, if applicable.
- 8. Criteria for compatibility, in terms of quantity of materials, system pressure and temperature, and exposure.

It is recommended that all information presently available and being developed as a result of new research and development programs be readily retrievable.

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IB2a-l	Structural Materials Compatibility	September 2,	1971	2 pages
	Relationship of Material Strength			
	to Maximum Stress Over the Working			
	Temperature Range			
IB2c.l	Structural Materials Compatibility	September 2,	1971	1 page
	Notch Sensitivity	•		



IB2d-1	Structural Materials Compatibility Fabrication and Welding	October 28, 1971	l page
IB2e(2)-1	Structural Materials Compatibility Materials and Parts Suitability Controls Vendor Procedures on Purchased Equipment	September 2, 1971	1 page

II. Operational Hazards

<u>Ove</u>	rpr	es	sur	e.

IIA-1 IIA4-1	Overpressure Integrity of Insulation Shop Fabricated LOX Storage Tanks	February 18, December 30,	
IIA4-2	Integrity of Insulation Field Fabricated, flat bottom LOX Storage Tanks	December 30,	1971 l pag

Disposal of Vented Gases

IIB-1	Company Practices	November	1, 1971	5 pages
IIB1-1	Cleanliness of Disposal System (compatibility with oxidizer)	February	12, 1972	2 pages
IIB1-2 IIB4-1	Cleanliness of Oxygen Piping Procedural Arrangements	•	19, 1972 19, 1972	l page l page

Coupling to Other Systems

IICl-1 &	Isolation Arrangements	(leakage)	December 22, 1971	1 page
TTC2-1	Temperature Isolation			

Spills and Leakage

IID-1	Spills and Leakage - General	September 3, 1971	2 pages
IID1-1	Drainage and Ultimate Disposal Arrangements	August 22, 1971	2 pages
IID2-1	Separation of Incompatible Materials and Ignition Sources in Disposal Systems	August 22, 1971	l page
IID3-1	Environmental Warnings and Escape Systems	August 22, 1971	l page
IID4-1	Detection: Quantity and Response Time Limits	August 22, 1971	l page



Contaminants	s Accumulation		
IIE-1	Procedures for Solvent Evaporation Technique, and for Extraction of Ether Soluble Material & Oil Content Determination	July 21, 1971	l page
Oxygen Trans	sfer		
IIF1-1	Production to Storage, Storage to System, Storage to Transport, Transport to System	December 22, 1971	l page
IIF1-2	Production, Storage to System, Storage to Transport, Transport to System Loading and Unloading Procedures for Liquid Oyxgen Transfer	August 22, 1971	1 page
IIF1-3	Systems - Field Fabricated Cryogenic Liquid Storage Tanks	February 3, 1972	l page
IIF1-14	Systems - APL Oxygen Transfer Methods Typical Installations, and Operations Department Overhaul Procedures for Liquid Pumps.	February 21, 1972	l page
IIF2-1	Pipeline Transportation - List of Standards	February 8, 1972	2 pages
IIF2-2	Pipeline Transportation - APL Oxygen Pipeline Design Concepts and Criteria	February 21, 1972	l page
IIF2a-l	Road, Railroad, Barge, and Pipeline Transportation Pressure Relief	August 22, 1971	1 page
IIF2b-l	Road, Railroad, Barge, and Pipeline Transportation Contamination Control	September 3, 1971	l page
IIF2c-l	Road, Railroad, Barge and Pipeline Transportation Oxygen Dispersal From Vents and Lines	August 22, 1971	l page
IIF2d-l	Road, Railroad, Barge and Pipeline Transportation Vehicle Accident Procedures	August 22, 1971	1 page
IIF2e-l	Road, Railroad, Barge and Pipeline Transportation Vibration and Controlled Sloshing	August 22, 1971	l page
IIF3 -1	Malfunctions and Failures	November 12, 1971	1 page
IIF3····2	Malfunctions and Failures APCI Incidents Involving Oxygen Transfer Equipment or Instrumentation	February 4, 1972	2 pages
IIF3 ~ 3	Malfunctions and Failures Incidents which Occurred with Other Oxygen Equipment	February 3, 1972	2 pages



Oxygen Transf	Cer (Continued)		
IIF3-4	Equipment Malfunctions and Failures Compressors and Pumps	January 23, 1972	15 pages
IIF3a-1	Equipment Malfunctions and Failures Equipment - Gas Pressure Regulators	December 10, 1971	3 pages
IIF3a(3)-1	Malfunctions and Failures Equipment - Valves	December 30, 1971	l page
IIF3b-l	Malfunctions and Failures Geisering, Excessive Vibrations, Shock (Thermal and Pressure), Line Surges	February 18, 1972	l page
IIF3c-l	Malfunction and Failures Insulation System deterioration due to Vibrations	December 30, 1971	l page
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IIG-1	Methods to Contain or Restrict Combustible Mixtures	November 1, 1971	6 pages
	III. Maintenance Program		
System Check	and Inspection; Where, Why, and How		
IIIAl-1	Structure	September 12, 1971	l page
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IIIA4-1	Insulation	September 12, 1971	l page
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IIIA5-2	Preventive Maintenance Program	September 12, 1971	5 pages
Cleaning Pro	cedures		
IIIB-1	Safe Cleaning Procedures for Filters Traps, and Instruments		2 pages
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IIIC-1	Steps Followed in Pressure Testing	September 12, 1971	3 pages



IV. System Emergencies

Area Placarding Warning Devices IVB-1 Warning Devices for Oxygen Systems - November 12, 1971 5 p. General Applications Protection IVC1-1 Personnel Protection & Equipment January 13, 1972 6 p. IVC2-1 Buildings and Adjacent Systems January 10, 1972 4 p. Protection Hazards Protection IVE-1 General Precautions November 8, 1971 2 p.	age							
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V-2 Accidents Involving Oxygen Equipment February 4, 1972 26 p	ages	26	4, 1972	February 1		ring Oxygen Equipment	-2 Accidents Involv	V-2
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and property are listed.						are listed.	and property	
	ages	2	21, 1972	February 2				V-3
Departments Reports related to								
Accidents Involving Oxygen			the same of the same are					
Precautions, Accidents, and Near	ages	2	972	May 12, 19			-4 APCI Documents	V-4
	ages	2	972	May 12, 19		list covering safety		V=4
Misses Involving Oxygen or Air	ages	2	972	May 12, 19		List covering safety Accidents, and Near	Precautions,	V=4



I. Material Compatibility

- A. Lubricants ~
 - 1. Krytox 143 AA oil (duPont)
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices
 - (a) Motor Bearing lubrication for liquid oxygen pump assemblies.
- B. Information Sources
 - 1. Company Practices
 - b. Company Operating Experience.

- c. Based on Research and Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, P. 12, 13, August 23, 1968 (Doc. # 99000126).



I. Material Compatibility

A. Lubricants

- 1. Halocarbon 11-21E, Halocarbon Products Corporation
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

(1) Company Practices

- (a) High pressure reciprocating pumps. Lubricant is not in direct oxygen contact, but in drive train of pump where the possibility of intimate contact exists.
- (b) As the hydraulic fluid in diaphragm compressors in oxygen service.
- (c) Not to be used with aluminum, magnesium, or their alloys under conditions of high torque or shear.

B. Information Sources

- 1. Company Practices
 - c. Based on Research and Development of Others
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 28, December 4, 1963 (Doc. # 99000128).



I. Material Compatibility

A. Lubricants

- 1. Halocarbon 11-14E, Halocarbon Products Corporation
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices
 - (a) Centrifugal liquid oxygen pump drive trains bearings where intimate contact is possible.
 - (b) Vertically mounted multi-stage centrifugal liquid oxygen pump drive motor bearings
 - (c) Not to be used with aluminum, magnesium, or their alloys under conditions of high torque or shear.

B. Information Sources

1. Company Practices

(1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III," NASA TM X-53533, P. 12, Nov. 3, 1966, (Doc. #99000125).



I. Material Compatibility

A. Lubricants

- 1. Halocarbon 6-25 Wax, Halocarbon Products Corporation
 - a. Specific Oxygen Environment

Ambient temp. to 160°F up to 1500 psig gaseous oxygen

- (1) Company Practices
 - (a) Protective coating of oxygen compressor spare parts and compressor components during storage. Coating is not removed prior to using equipment.
 - (b) Not to be used with aluminum, magnesium, or their alloys under conditions of high torque or shear.

B. Information Sources

1. Company Practices

e. Other

Schmoyer, W. W., "Oxygen Compressors", February 6, 1969 (Doc #99000138). Record of telecon with Halocarbon Products, Feb. 4, 1969. Wax 6-25 is a mixture of 25% Halocarbon 600 wax and 75% Freon 113. The Freon evaporates upon application leaving a protective coating on the surface.



I. Material Compatibility

A. Lubricants

- 1. Kel F-90 grease, Minnesota Mining & Manufacturing Co.
 - a. Specific Oxygen Environment

Gaseous Oxygen, ambient temp, pressures to 3000 psi.

- (1) Company Practices
 - (a) Laboratory glassware, analyzers, and testing apparatus in contact with gaseous oxygen.
 - (b) Some lubricant function in valves in gaseous oxygen service.
 - (c) "0" ring and diaphragm lubricant in oxygen regulators
 - (d) Not to be used with aluminum, magnesium, or their alloys under conditions of high torque or shear.
 - (e) No longer manufactured. Will be replaced by Halocarbon 25-5S grease -- Refer IAla-6

B. Information Sources

- 1. Company Practices
 - a. Company Research
 - (1) Walde, R. A., Flammability and Explosion Hazards, APCI 87-0-8822, May 1963 (Doc. #99000072).
 - c. Based on Research and Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, P. 28, December 4, 1963 (Doc #99000128).



I. Material Compatibility

- A. Lubricants
 - 1. Halocarbon 25-5S grease, Halocarbon Products Corp.
 - a. Specific Oxygen Environment

Gaseous Oxygen, ambient temp., pressures to 3000 psi

- (1) Company Practices
 - (a) Laboratory glasswear, analyzers, and testing apparatus in contact with gaseous oxygen.
 - (b) Some lubricant functions in valves in gaseous oxygen service.
 - (c) "0" ring and diaphragm lubricant in oxygen regulators.
 - (d) Not to be used with aluminum, magnesium, or their alloys under conditions of high torque or shear.

B. Information Sources

- 1. Company Practices
 - c. Based on Research and Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV", NASA TM X-53773, p. 12, August 23, 1968 (Doc. #99000126).



I. Material Compatibility

A. Lubricants

- 1. Fluorolube, FS, Hooker Chemical
 - a. Specific Oxygen Environment

Gaseous oxygen service, ambient temperature to -297°F pressures to 3000 psig

- (1) Company Practices
 - (a) Internal threaded devices in Air Separation Plant distillation columns.
 - (b) On teflon tape on some NPT screwed connections to improve the lubricity of the system for better seal.
 - (c) Bonnet and stem threads and other valve parts exposed to oxygen service.
 - (d) Not to be used with aluminum, magnesium, or their alloys under conditions of high torque or shear.

B. Information Sources

- 1. Company Practices
 - a. Company Research
 - (1) Ent, W. L., "Investigation of The Resistant Qualities of Cellulubes 220," TM #40, Sept. 18, 1959 (Doc. #99000140). Technical Memorandum TM No. 40 references LOX bomb tests of Hooker's Fluorolube FS and FS 5 and Kellog's Kel-F 3 oils.
 - b. Company Operating Experience.

Chlorotrifluoroethylene Family of lubricants are permitted to be used where lubricants are needed in contact with oxygen. Each application is reviewed.

- c. Based on Research and Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen III", NASA TM X-53533, p. 9, November 3, 1966, (Doc. #99000125).



I. Material Compatibility

- A. Lubricants
 - 1. Krytox 143 AB oil (duPont)
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices
 - (a) Motor Bearing lubrication for liquid oxygen pump assemblies.
- B. Information Sources
 - 1. Company Practices
 - b. Company Operating Experience.

- c. Based on Research and Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, P. 12, 13, August 23, 1968 (Doc. # 99000126).



I. Material Compatibility

- A. Lubricants
 - 1. Krytox 143 AC oil (duPont)
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices
 - (a) Motor Bearing lubrication for liquid oxygen pump assemblies.

B. Information Sources

- 1. Company Practices
 - b. Company Operating Experience.

- c. Based on Research and Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, P. 12, 13, August 23, 1968 (Doc. # 99000126).



I. Material Compatibility

- A. Lubricants
 - 1. Krytox 143 AZ oil (duPont)
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices
 - (a) Motor Bearing lubrication for liquid oxygen pump assemblies.

B. Information Sources

- 1. Company Practices
 - b. Company Operating Experience.

- c. Based on Research and Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, P. 12, 13, August 23, 1968 (Doc. # 99000126).



I. Material Compatibility

- A. Lubricants
 - 1. Fluorolube, FS 5, Hooker Chemical
 - a. Specific Oxygen Environment

Gaseous oxygen service ambient temperature to -297°F, pressures to 3000 psig

- (1) Company Practices
 - (a) Transmitters and liquid level gauges in oxygen service
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Ent, W. L., "Investigation of The Resistant Qualities of Cellulubes 220," TM #40, Sept. 18, 1959 (Doc. #99000140). Technical Memorandum TM No. 40 references LOX bomb tests of Hooker's Fluorolube FS and FS 5 and Kellog's Kel-F 3 oils.
 - (2) Foster, R. H., APCI Safety, Hazards, and Explosion Testing Ignition Test Apparatus, Florulube Greases, Epoxy Compounds Devcon 2 Ton and Devcon F, Foam Type Insulations -- Styrofoam and Polyurethane Foam Insulation, Raybestos Manhattan Packing and Impregnated Asbestos Rope Material, APCI MAR 87-0-8821, February 1962 (Doc. #99000066).
 - b. Company Operating Experience.

Chlorotrifluoroethylene Family of lubricants are permitted to be used where lubricants are needed in contact with oxygen. Each application is reviewed.

- c. Based on Research and Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen III", NASA TM X-53533, p. 9, November 3, 1966, (Doc. #99000125).

I. Material Compatibility

A. Lubricants

- 1. Molylube "N" Bel-Ray Co., Farmingdale, N. J.
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperatures to -297°F pressures to 3000 psig.

- (1) Company Practices
 - (a) Used in small capacity liquid oxygen reciprocating pumps to correct a seizure problem between stainless and aluminum thread joints.
 - (b) Used as thread lubricant on oxygen regulators

B. Information Sources

1. Company Practices

- a. Company Research
 - (1) Brophy, M., R&D Tests of Oxygen Compatibility, R&D Notebook #130, p. 16 & 17, Feb. 11, 1963, (Doc. #99000120).
 - (2) Foster, R. H., APCI Safety, Hazards, and Explosion Testing -- Epon H-60, Polycel 440R, and Styrofoam, Lubricants, Moly Spray Kote, and Dri Lube, APCI MAR 87-0-8821, April 1962 (Doc. #99000068).
 - (3) Walde, R. A., APCI Flammability and Explosion Hazards, Oxygen Pressure Gauge TWF Wool, Spintex 305, Molykote Type Z and Type X-15, APCI MAR 87-0-8822, March 1963 (Doc. #99000071).
- b. Company Operating Experience.
 - (1) Schmoyer, W. W., "Regulator Thread Sealant," Oct. 4, 1963, (Doc. #99000119).
- c. Based on Research & Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, p. 14, August 23, 1968, (Doc. #99000126).



I. Material Compatibility

A. Lubricants

- 1. Moly Lube No. 99, Moly Lube Products, Glen Cove, N. Y.
 - a. Specific Oxygen Environment

Exposure is to air at ambient temperature and atmospheric pressure excepting in cases of leaks in process system then the exposure is to gaseous and liquid oxygen, ambient temperature to -297°F, atmospheric pressure

- (1) Company Practices
 - (a) Used as a lubricant for some screw threads on bolts and studs as an aid to disassembly of parts. Usually not in oxygen product stream.

B. Information Sources

- 1. Company Practices
 - a. Company Research
 - (1) Brophy, M., R&D Tests with High Pressure Oxygen, R&D Notebook #130, p. 31, June 1963, (Doc. #99000123). Bomb test at 2000 psig
 - (2) Walde, R. A., "Gaseous Oxygen Compatibility Test on Moly Lube No. 99", June 11, 1963, (Doc. #99000117)
 - (3) Foster, R. H., APCI Safety, Hazards, and Explosion Testing -- Epon H-60, Polycel 440R, and Styrofoam, Lubricants, Moly Spray Kote, and Dri Lube, APCI MAR 87-0-8821, April 1962 (Doc. #99000068).
 - (4) Walde, R. A., APCI Flammability and Explosion Hazards, Oxygen Pressure Gauge TWF Wool, Spintex 305, Molykote Type Z and Type X-15, APCI MAR 87-0-8822, March 1963 (Doc. #99000071).



I. Material Compatibility

A. Lubricants

- 1. Fluoro-glide, Chemplast Inc.
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature, pressures to 250 psig.

- (1) Company Practices
 - (a) Used as an alternate lubricant to fluorolubes when required for oxygen control and distribution system valve stems under conditions which warrant the use of a lubricant.

- 1. Company Practices
 - a. Company Research
 - (1) Yoder, L., Analytical Report on Flammability in 100% gaseous oxygen, 61-262, April 11, 1961, (Doc #99000139).
 - c. Based on Research and Development of Others
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," NASA TM X-985, p. 16, August 1964, (Doc. #99000127).



I. Material Compatibility

- A. Lubricants
 - 1. Krytox 143 AD oil (duPont)
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices
 - (a) Motor Bearing lubrication for liquid oxygen pump assemblies.
- B. Information Sources
 - 1. Company Practices
 - b. Company Operating Experience.

Was on a trial basis for replacement of Halocarbon lubricants which do not appear to have the lubricity and mechanical properties necessary for our application. However its performance was unacceptable.

- c. Based on Research and Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, P. 12, 13, August 23, 1968, (Doc. # 99000126).



I. Material Compatibility

- A. Lubricants
 - 1. Voltalef 3A (Kingsley and Keith Limited, U.K.)
 - a. Specific Oxygen Environment

Normal exposure is to air at ambient temperature, but may be exposed to gaseous or liquid oxygen, at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices (APL)
 - (a) Centrifugal liquid oxygen pump drive trains bearings where intimate contact is possible.
 - (b) Vertically mounted multi-stage centrifugal liquid oxygen pump drive motor bearings.



I. Material Compatibility

- A. Lubricants
 - 1. Esso Beacon 325
 - a. Specific Oxygen Environment

Normal exposure is to air at ambient temperature, but may be exposed to gaseous or liquid oxygen, at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices (APL)
 - (a) Oxygen Pump motor bearings (Byron Jackson).
 - (b) Cryostar direct drive pump motor bearings.



I. Material Compatibility

- A. Lubricants
 - 1. Formblin Y04 (Montecatini Edison)
 - a. Specific Oxygen Environment

Normal exposure is to air at ambient temperature, but may be exposed to gaseous or liquid oxygen, at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices (APL)
 - (a) This lubricant at present is being tested on a LIN pump for its lubrication properties prior to use on Centrifugal liquid oxygen pump gear box.



- I. Material Compatibility
 - A. Sealants & Threading Compounds
 - 1. Permatex #1516
 - a. Specific Oxygen Environment

Gaseous Oxygen, Ambient Temperature to 160°F, pressure to 4500 psig.

- (1) Company Practices
 - (a) Centrifugal oxygen compressor, as a gasket material on the case halves of centrifugal oxygen compressors. Used in conjunction with GE RTV 60 Silicone rubber applied to the bearing portion of the case halves.
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Brophy, M., Compatibility Tests with High Pressure Oxygen, R&D Notebook #111 p. 152, Jan. 1963 (Doc #99000122). The ignition bomb and test method is described in memo from E. Kehat, subject: "Development of Standard Ignition Test, Interim Report. Project No. 87-0-8820/1" Dated Nov. 17, 1961. (Doc #99000109).
 - b. Company Operating Experience
 - (1) Satisfactory experience as a gasket material on the case halves of centrifugal oxygen compressors. Used in conjunction with GE RTV 60 Silicone rubber applied to the bearing portion of the case halves.

I. Material Compatibility

- A. Sealants & Threading Compounds
 - 1. Teflon Tape -- Permacel
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, vacuum to 3000 psi pressures.

- (1) Company Practices
 - (a) All National Pipe Thread (NPT) screwed connections used in oxygen service.
 - (b) APCI Design Engineering Standard 570.5.1 Nov. 1960 (Doc. #99000118).
 - (c) APCI Safety Standard 609.1, June 1964 (Doc. #99000051).
 - (d) APCI Safety Gram No. 27, Lubricants and Thread Components for Oxygen Systems, March 22, 1963 (Doc. #99000009).

B. Information Sources

- 1. Company Practices
 - a. Company Research.

Material tests performed by R&D on Permacel #412 Tape in 1959, no reactions in LOX bomb tests and no ignition in open flame. Mechanical performance tests at the same time indicated good acceptance for threaded joints and led to issuance of Design Engineering Standard 570.5.1 in November 1960 and Safety Standard 609.1 in June 1964. Further testing in 1936, 1964, and 1965 in a 2000 psig oxygen bomb indicated some reactions occurred. No reactions occurred when tape was thoroughly solvent cleaned prior to testing. Later solvent washings were analyzed to be hydrocarbon contaminated to an extend of 0.34 and 2.68 mg/sq. ft. of tape. Most popular brand names of tape have been tested with results similar to above tests.

- (1) Dinan, E., Jan. 28, 1959. (Doc. #99000111). Permacel Ribbon Dope, is Item 3.
- (2) Yoder, L., Analytical Report on % Hydrocarbon Contaminant, 61-3, Jan. 16, 1961 (Doc. #99000116).



- (3) Walde, R. A., "Gaseous Oxygen Compatibility of Crosslite Fluorocarbon Tape" July 30, 1963 (Doc. #99000113). Permacel Tape was compared to Crosslite Tape and 3M Fluorocarbon Tape.
- (4) Foster, R. H., APCI Safety, Hazards, and Explosion Testing Ignition Test Apparatus, Fluorlube Greases, Epoxy Compounds Devcon 2 Ton and Devcon F, Foam Type Insulations -- Styrofoam and Polyurethane Foam Insulation, Raybestos Manhattan Packing and Impregnated Asbestos Rope Material, APCI MAR 87-0-8821, February 1962 (Doc. #99000066).
- (5) Foster, R. H., APCI Safety, Hazards, and Explosion Testing -- Polyester Resin Impregnated Fiberglass Lava, APCI MAR 87-0-8821, March 1962 (Doc. #99000067).
- b. Company Operating Experience.

No reactions have occurred between oxygen and teflon tape in actual operating experience. The space occupied by the teflon tape in threaded connections reduces the exposure and thereby minimizes the potential for reaction.

c. Based on Research and Development of Others.

NASA publications regarding Compatibility of Materials with Liquid Oxygen is used as a guide for selection of teflon tape, other teflon products, and other inert materials of similar formulation.

- (1) NASA-MSC, "Nonmetallic Materials Design Guide Lines and Test Data Handbook," MSC-02681, May 29, 1970 (Doc. #99000129).
- (2) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 35, December 4, 1963, (Doc. #99000128).
- (3) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," NASA TM X-53052, P. 13, May 26, 1964. (Doc. #99000124).
- (4) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III", NASA TM X-53533, p. 17, November 3, 1966, (Doc. #99000125).
- (5) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, p. 16, August 23, 1968, (Doc. #99000126).



I. Material Compatibility

- A. Sealants & Threading Compounds
 - 1. T-Film, Eco Mfgr. Co.
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, vacuum to 3000 psi pressure.

- (1) Company Practices
 - (a) On all pipe threads. Limited use, as the principal sealant is teflon tape. Used only in special applications where teflon tape has caused assembly problems. Specifically, for threaded connections in oxygen regulator assembly.

B. Information Sources

- 1. Company Practices
 - a. Company Research
 - (1) Yoder, L., Analytical Report on Flammability in 100% gaseous oxygen, Autoignition at 1 atmoshpere oxygen. Sept. 18, 1961, 61-683, (Doc. #99000114).
 - (2) Kehat, E., "Ignition tests of "T" Film and Penton," Nov. 28, 1961, (Doc. #99000100). 2000 psig bomb test.
 - (3) Kitson, F. K., "Assembly of Oxygen Regulators" November 30, 1961. (Doc. #99000110)
 - (4) Kehat, E., APCI Safety, Hazards, and Explosion Testing -- Silicon Oils, Dow Corning RF-1-0065, Silicon Oils Dow Corning RF-1-0065, Indopol Polybutene Oil Amoco L-10, Indopol Polybutene Oil Amoco H-100, Penton, T-Film Thread Compound, APCI MAR 87-0-8821, November 1961 (Doc. #9900063).
 - b. Company Operating Experience

Experience satisfactory, but limited.

- c. Based on Research and Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 34, December 4, 1963, (Doc. #99000128).



- I. Material Compatibility
 - A. Sealants & Threading Compounds
 - 1. Putti-Rope, National Greenhouse Co.
 - a. Specific Oxygen Environment

Exposure is normally to an inert or air atmosphere excepting when a leak in process system causes oxygen enrichment. Exposure under these conditions is gaseous or liquid oxygen. Ambient temperature to -297°F, atmospheric pressure.

- (1) Company Practices
 - (a) Panel sealant on cold box closures.
 - (b) Safety standard 609.1, June 1964, (Doc. #99000051).
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Ent, W. L., "Putti-rope"; Analysis for Oil Content and Flammability Temperature," Dec. 11, 1959, (Doc. #99000112).



I. Material Compatibility

- A. Sealants & Threading Compounds
 - 1. Molylube "N" Bel-Ray Co., Farmingdale, N. J.
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature, pressures to 3000 psig.

- (1) Company Practices
 - (a) Approved substitute for teflon tape on oxygen regulators where plating has reduced thread joint clearance making assembly difficult when using teflon tape.

- 1. Company Practices
 - a. Company Research
 - (1) Brophy, M., R&D Oxygen compatibility Test -- R&D Notebook #130, p. 16, 17, Feb. 11, 1963, (Doc. #99000120)
 - b. Company Operating Experience.
 - (1) Schmoyer, W. W., "Regulator Thread Sealant", Oct. 4, 1963. (Doc. #99000119) Safety Dept. Correspondence authorizing use.
 - c. Based on Research & Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, p. 14, August 23, 1968, (Doc. #99000126).



I. Material Compatibility

- A. Sealants & Threading Compounds
 - 1. Crosslite Fluorocarbon Tape
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, vacuum to 3000 psi pressures.

- (1) Company Practices
 - (a) All National Pipe Thread (NPT) screwed connections used in oxygen service.
 - (b) APCI Design Engineering Standard 570.5.1 Nov. 1960 (Doc. #99000118).
 - (c) APCI Safety Standard 609.1, June 1964 (Doc. #99000051).

B. Information Sources

- 1. Company Practices
 - a. Company Research.

Material tests performed by R&D on Permacel #412 Tape in 1959, no reactions in LOX bomb tests and no ignition in open flame. Mechanical performance tests at the same time indicated good acceptance for threaded joints and led to issuance of Design Engineering Standard 570.5.1 in November 1960 and Safety Standard 609.1 in June 1964. Further testing in 1936, 1964, and 1965 in a 2000 psig oxygen bomb indicated some reactions occurred. No reactions occurred when tape was thoroughly solvent cleaned prior to testing. Later solvent washings were analyzed to be hydrocarbon contaminated to an extend of 0.34 and 2.68 mg/sq. ft. of tape. Most popular brand names of tape have been tested with results similar to above tests.

(1) Walde, R. A., "Gaseous Oxygen Compatibility of Crosslite Fluorocarbon Tape" July 30, 1963 (Doc. #99000113). Permacel Tape was compared to Crosslite Tape and 3M Fluorocarbon Tape.

b. Company Operating Experience.

No reactions have occurred between oxygen and teflon tape in actual operating experience. The space occupied by the teflon tape in threaded connections reduces the exposure and thereby minimizes the potential for reaction.

c. Based on Research and Development of Others.

NASA publications regarding Compatibility of Materials with Liquid Oxygen is used as a guide for selection of teflon tape, other teflon products, and other inert materials of similar formulation.

- (1) NASA-MSC, "Nonmetallic Materials Design Guide Lines and Test Data Handbook," MSC-02681, May 29, 1970 (Doc. #99000129).
- (2) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 35, December 4, 1963, (Doc. #99000128).
- (3) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," NASA TM X-53052, P. 13, May 26, 1964. (Doc. #99000124).
- (4) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III", NASA TM X-53533, p. 17, November 3, 1966, (Doc. #99000125).
- (5) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, p. 16, August 23, 1968, (Doc. #99000126).



I. Material Compatibility

- A. Sealants & Threading Compounds
 - 1. Damco Tape
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, vacuum to 3000 psi pressures.

- (1) Company Practices
 - (a) All National Pipe Thread (NPT) screwed connections used in oxygen service.
 - (b) APCI Design Engineering Standard 570.5.1 Nov. 1960 (Doc. #99000118).
 - (c) APCI Safety Standard 609.1, June 1964 (Doc. #99000051).

B. Information Sources

- 1. Company Practices
 - a. Company Research.

Material tests performed by R&D on Permacel #412 Tape in 1959, no reactions in LOX bomb tests and no ignition in open flame. Mechanical performance tests at the same time indicated good acceptance for threaded joints and led to issuance of Design Engineering Standard 570.5.1 in November 1960 and Safety Standard 609.1 in June 1964. Further testing in 1936, 1964, and 1965 in a 2000 psig oxygen bomb indicated some reactions occurred. No reactions occurred when tape was thoroughly solvent cleaned prior to testing. Later solvent washings were analyzed to be hydrocarbon contaminated to an extend of 0.34 and 2.68 mg/sq. ft. of tape. Most popular brand names of tape have been tested with results similar to above tests.

(1) Frederick, L. G., Analytical Report on % Ether Extractable Contaminants and Fluorescence. 70-368, Oct. 7, 1970, (Doc. #99000115).



b. Company Operating Experience.

No reactions have occurred between oxygen and teflon tape in actual operating experience. The space occupied by the teflon tape in threaded connections reduces the exposure and thereby minimizes the potential for reaction.

c. Based on Research and Development of Others.

NASA publications regarding Compatibility of Materials with Liquid Oxygen is used as a guide for selection of teflon tape, other teflon products, and other inert materials of similar formulation.

- (1) NASA-MSC, "Nonmetallic Materials Design Guide Lines and Test Data Handbook," MSC-02681, May 29, 1970 (Doc. #99000129).
- (2) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 35, December 4, 1963, (Doc. #99000128).
- (3) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," NASA TM X-53052, P. 13, May 26, 1964. (Doc. #99000124).
- (4) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III", NASA TM X-53533, p. 17, November 3, 1966, (Doc. #99000125).
- (5) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, p. 16, August 23, 1968, (Doc. #99000126).



I. Material Compatibility

- A. Sealants & Threading Compounds
 - 1. Sanden Tape
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to $-297^{\circ}F$, vacuum to 3000 psi pressures.

- (1) Company Practices
 - (a) All National Pipe Thread (NPT) screwed connections used in oxygen service.
 - (b) APCI Design Engineering Standard 570.5.1 Nov. 1960 (Doc. #99000118).
 - (c) APCI Safety Standard 609.1, June 1964 (Doc. #99000051).

B. Information Sources

- 1. Company Practices
 - a. Company Research.

Material tests performed by R&D on Permacel #412 Tape in 1959, no reactions in LOX bomb tests and no ignition in open flame. Mechanical performance tests at the same time indicated good acceptance for threaded joints and led to issuance of Design Engineering Standard 570.5.1 in November 1960 and Safety Standard 609.1 in June 1964. Further testing in 1936, 1964, and 1965 in a 2000 psig oxygen bomb indicated some reactions occurred. No reactions occurred when tape was thoroughly solvent cleaned prior to testing. Later solvent washings were analyzed to be hydrocarbon contaminated to an extend of 0.34 and 2.68 mg/sq. ft. of tape. Most popular brand names of tape have been tested with results similar to above tests.

(1) Frederick, L. G., Analytical Report on % Ether Extractable Contaminants and Fluorescence. 70-368, Oct. 7, 1970, (Doc. #99000115).



b. Company Operating Experience.

No reactions have occurred between oxygen and teflon tape in actual operating experience. The space occupied by the teflon tape in threaded connections reduces the exposure and thereby minimizes the potential for reaction.

c. Based on Research and Development of Others.

NASA publications regarding Compatibility of Materials with Liquid Oxygen is used as a guide for selection of teflon tape, other teflon products, and other inert materials of similar formulation.

- (1) NASA-MSC, "Nonmetallic Materials Design Guide Lines and Test Data Handbook," MSC-02681, May 29, 1970 (Doc. #99000129).
- (2) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 35, December 4, 1963, (Doc. #99000128).
- (3) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," NASA TM X-53052, P. 13, May 26, 1964. (Doc. #99000124).
- (4) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III", NASA TM X-53533, p. 17, November 3, 1966, (Doc. #99000125).
- (5) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, p. 16, August 23, 1968, (Doc. #99000126).



I. Material Compatibility

- A. Sealants & Threading Compounds
 - 1. Crane Packing Co. Tape
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, vacuum to 3000 psi pressures.

- (1) Company Practices
 - (a) All National Pipe Thread (NPT) screwed connections used in oxygen service.
 - (b) APCI Design Engineering Standard 570.5.1 Nov. 1960 (Doc. #99000118).
 - (c) APCI Safety Standard 609.1, June 1964 (Doc. #99000051).

B. Information Sources

- 1. Company Practices
 - a. Company Research.

Material tests performed by R&D on Permacel #412 Tape in 1959, no reactions in LOX bomb tests and no ignition in open flame. Mechanical performance tests at the same time indicated good acceptance for threaded joints and led to issuance of Design Engineering Standard 570.5.1 in November 1960 and Safety Standard 609.1 in June 1964. Further testing in 1936, 1964, and 1965 in a 2000 psig oxygen bomb indicated some reactions occurred. No reactions occurred when tape was thoroughly solvent cleaned prior to testing. Later solvent washings were analyzed to be hydrocarbon contaminated to an extend of 0.34 and 2.68 mg/sq. ft. of tape. Most popular brand names of tape have been tested with results similar to above tests.

(1) Frederick, L. G., Analytical Report on % Ether Extractable Contaminants and Fluorescence. 70-368, Oct. 7, 1970, (Doc. #99000115).

b. Company Operating Experience.

No reactions have occurred between oxygen and teflon tape in actual operating experience. The space occupied by the teflon tape in threaded connections reduces the exposure and thereby minimizes the potential for reaction.

c. Based on Research and Development of Others.

NASA publications regarding Compatibility of Materials with Liquid Oxygen is used as a guide for selection of teflon tape, other teflon products, and other inert materials of similar formulation.

- (1) NASA-MSC, "Nonmetallic Materials Design Guide Lines and Test Data Handbook," MSC-02681, May 29, 1970 (Doc. #99000129).
- (2) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 35, December 4, 1963, (Doc. #99000128).
- (3) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," NASA TM X-53052, P. 13, May 26, 1964. (Doc. #99000124).
- (4) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III", NASA TM X-53533, p. 17, November 3, 1966, (Doc. #99000125).
- (5) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, p. 16, August 23, 1968, (Doc. #99000126).



- I. Material Compatibility
 - A. Sealants & Threading Compounds
 - 1. Oxomat
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature, pressures to 3000 psig.

- (1) Company Practices
 - (a) Used as an alternate thread sealant in applications where teflon tape is not satisfactory. Approval from Safety Dept. is required in each specific application.
- B. Information Sources
 - 1. Company Practices
 - a. Company Research

Moysan, S. R., Analytical Report on Flammability in 100% gaseous oxygen, 61-435, June 6, 1961, (Doc. #99000121). Autoignition test in oxygen.



I. Material Compatibility

- A. Sealants & Threading Compounds
 - 1. 3M Fluorocarbon Tape
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, vacuum to 3000 psi pressures.

- (1) Company Practices
 - (a) All National Pipe Thread (NPT) screwed connections used in oxygen service.
 - (b) APCI Design Engineering Standard 570.5.1 Nov. 1960 (Doc. #99000118).
 - (c) APCI Safety Standard 609.1, June 1964 (Doc. #99000051).

B. Information Sources

- 1. Company Practices
 - a. Company Research.

Material tests performed by R&D on Permacel #412 Tape in 1959, no reactions in LOX bomb tests and no ignition in open flame. Mechanical performance tests at the same time indicated good acceptance for threaded joints and led to issuance of Design Engineering Standard 570.5.1 in November 1960 and Safety Standard 609.1 in June 1964. Further testing in 1936, 1964, and 1965 in a 2000 psig oxygen bomb indicated some reactions occurred. No reactions occurred when tape was thoroughly solvent cleaned prior to testing. Later solvent washings were analyzed to be hydrocarbon contaminated to an extend of 0.34 and 2.68 mg/sq. ft. of tape. Most popular brand names of tape have been tested with results similar to above tests.



IA2a-11 (Continued)

- (3) Walde, R. A., "Gaseous Oxygen Compatibility of Crosslite Fluorocarbon Tape" July 30, 1963 (Doc. #99000113). Permacel Tape was compared to Crosslite Tape and 3M Fluorocarbon Tape.
- b. Company Operating Experience.

No reactions have occurred between oxygen and teflon tape in actual operating experience. The space occupied by the teflon tape in threaded connections reduces the exposure and thereby minimizes the potential for reaction.

c. Based on Research and Development of Others.

NASA publications regarding Compatibility of Materials with Liquid Oxygen is used as a guide for selection of teflon tape, other teflon products, and other inert materials of similar formulation.

- (1) NASA-MSC, "Nonmetallic Materials Design Guide Lines and Test Data Handbook," MSC-02681, May 29, 1970 (Doc. #99000129).
- (2) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 35, December 4, 1963, (Doc. #99000128).
- (3) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," NASA TM X-53052, P. 13, May 26, 1964. (Doc. #99000124).
- (4) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III", NASA TM X-53533, p. 17, November 3, 1966, (Doc. #99000125).
- (5) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, p. 16, August 23, 1968, (Doc. #99000126).



I. Material Compatibility

- A. Sealants and Threading Compounds
 - 1. Sodium Silicate and China Clay Paste
 - a. Specific Oxygen Environment

Liquid and gaseous oxygen -300°F to +320°F, pressures up to 600 PSIG.

- (1) Company Practices
 - (a) Horizontal split seals on oxygen turbo compressor (G.H.H. Design).
 - (b) Valve bonnets.
 - (c) Valve seat threads.

B. Information Sources

- 1. Company Practices (APL)
 - b. Used in the above duties for several years without incident.
 - c. Based on Research and Development of Others

Recommended by British Cryogenics Council's Cryogenic Safety Manual, A Guide to Good Practice, 1970, London, Great Britain, (Doc. #99000359).



I. Material Compatibility

- A. Thermal & Electrical Insulations
 - 1. Foamglas (cellular glass) Insulation, Pittsburgh-Corning Corp.
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperatures -297°F and atmospheric pressure in the event of process leak. Also exposure may be to liquid air in the event of insulation-breakdown.

- (1) Company Practices
 - (a) Thermal insulation for oxygen transmission lines.
 - (b) Thermal insulation for any line operating at cryogenic temperatures below the liquefaction temperature of air.
 - (c) APCI Safety Standard 609.1, page 5, June 1964, (Doc. 99000051).
 - (d) APL Engineering Specification N.05, Rev. 0, January 2, 1970 (Doc. #99000381).

- 1. Company Practices
 - a. Company Research
 - (1) Yoder, L., Analytical Report on Flammability in 100% gaseous oxygen, 61-34 to 61-40 and 61-42, February 3, 1961, (Doc. #99000130).
 - c. Based on Research and Development of Others.
 - (1) Key, C. D. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen,"

 MTP-P&VE-M-63-14, p. 36, December 4, 1963,

 (Doc. #99000128).



I. Material Compatibility

- A. Thermal & Electrical Insulations
 - 1. Transite, Johns-Manville
 - a. Specific Oxygen Environment

Normal exposure is to inert or air atmosphere excepting when a leak in process system causes oxygen enrichment. Exposure under these conditions is gaseous or liquid oxygen, ambient temperature to -297°F, atmospheric pressure.

- (1) Company Practices
 - (a) Cold box vessel supports needed for shipping and not as structural supports. A replacement for wooden supports.
 - (b) APCI Safety Standard 609.1, page 5, June 1964. (Doc. #99000051).

- 1. Company Practices
 - a. Company Research
 - (1) Bauer, E., "Behavior of Transite Under Compressive Loads at Ambient and Liquid N₂ Temperatures" APCI TR #53, August 1962, (Doc. #99000134).



I. Material Compatibility

- A. Thermal & Electrical Insulations
 - 1. Glass Wool
 - s. Specific Oxygen Environment
 Normal exposure is to inert or air atmosphere
 excepting when a leak in process system causes
 oxygen enrichment. Exposure under these conditions
 is gaseous or liquid oxygen, ambient temp. to -297°F,
 atmospheric pressure.
 - (1) Company Practices
 - (a) Thermal insulation in cold boxes.
 - (b) APCI Design Engineering Standard 581.3, Oct. 24, 1960. (Doc. #99000041).
 - (c) APCI Safety Standard 609.1, p. 4, June 1964. (Doc. #99000051).
 - (d) Batch analysis for oil content required on every shipment per QCL 103L. (Doc. #99000131). Maximum allowed oil contamination is 3.5 lbs. per ton of glass wool.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 38, December 4, 1963, (Doc. #99000128).



I. Material Compatibility

- A. Thermal & Electrical Insulations
 - 1. Mineral Wool
 - a. Specific Oxygen Environment

Normal exposure is to inert or air atmosphere excepting when a leak in process system causes oxygen enrichment. Exposure under these conditions is gaseous or liquid oxygen, ambient temp. to -297°F and atmospheric pressure.

- (1) Company Practices
 - (a) Thermal Insulation for cold boxes.
 - (b) APCI Safety Standard 609.1, p. 4, June 1964 (Doc. #99000051).
 - (c) APCI Design Engineering Standard 581.2, June 26, 1969, (Doc. #99000040).
 - (d) Batch analysis for oil content required on every shipment of Rockwool per QCL 103L. (Doc. #99000131). Maximum allowable oil contamination is 3.5 lbs. per ton of mineral wool.
 - (e) APL Engineering Specification N.02, Rev. 0, January 2, 1970 (Doc. #99000380).

- 1. Company Practices
 - a. Company Research
 - (1) Himmelberger, F. "Quality Control of Rockwool" November 6, 1959. (Doc. #99000145).
 - (2) Bassler, E. "Production of Rockwool Bethlehem Steel Company," November 12, 1959, (Doc. #99000147).



- Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen,"
 MTP-P&VE-M-63-14, p. 38, December 4, 1963,
 (Doc. #99000128).
 - (2) Matthews, W. D., and G. G. Owen, ICI Ltd, "Safety Aspects of Reconstructed ICI Oxygen Plant", AIChE, Safety in Air and Ammonia Plants, Vol. 5, p. 11, 1963. (Doc. #99000103).

I. Material Compatibility

A. Thermal & Electrical Insulations

1. Perlite

a. Specific Oxygen Environment

Normal exposure is to inert or air atmosphere excepting where a leak in process system causes oxygen enrichment. Exposure under these conditions is gaseous or liquid oxygen, ambient temp. to -297°F and atmoshperic pressure.

(1) Company Practices

- (a) Thermal insulation for cold boxes.
- (b) APCI Design Engineering Standard 581.1, May 26, 1961. (Doc. #99000039).
- (c) APCI Safety Standard 609.1, p. 4, June 1964. (Doc. #99000051).
- (d) APL Engineering Specification N.Ol, Rev. 0, January 2, 1970 (Doc. #99000379).
- (e) Campbell, R. W. and B. W. Taylor, Use of Perlite in Air Separation Cold Boxes, APCI TB 39, June 14, 1971 (Doc. #99000038).



I. Material Compatibility

- A. Thermal & Electrical Insulations
 - 1. Milfoam -- Milfoam Corporation
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperatures to -297°F and atmospheric pressure in the event of a process leak. Also, exposure may be to liquid air in the event of insulation breakdown.

- (1) Company Practices
 - (a) Thermal insulation for oxygen transmission lines as an alternate material for Foamglas under conditions where Foamglas is used 5 feet on either side of a leak potential joint (flange, valve, etc.)
 - (b) APCI memorandum, Kitson, F. K., Insulation Materials for Cryogenic Systems, November 1, 1968 (Doc. #99000292).

- 1. Company Practices
 - a. Company Research
 - (1) APCI memorandum, Schmauch, G., Flammability Tests on Insulation, October 24, 1968 (Doc. #99000293).



I. Material Compatibility

- A. Thermal & Electrical Insulations
 - 1. National Gypsum Blue National Gypsum Corporation
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperatures to -297°F and atmospheric pressure in the event of a process leak. Also, exposure may be to liquid air in the event of insulation breakdown.

- (1) Company Practices
 - (a) Thermal insulation for oxygen transmission lines as an alternate material for Foamglas under conditions where Foamglas is used 5 feet on either side of a leak potential joint (flange, valve, etc.) with the balance of the insulation as National Gypsum Blue.
 - (b) APCI memorandum, Kitson, F. K., Insulation Materials for Cryogenic Systems, November 1, 1968 (Doc. #99000292).

- 1. Company Practices
 - a. Company Research
 - (1) APCI memorandum, Schmauch, G., Flammability Tests on Insulation, October 24, 1968 (Doc. #99000293).



I. Material Compatibility

- A. Plastics, Elastomers, and Adhesives
 - 1. RTV-60, Silicone Rubber Compound with SS-4004 silicone primer, G. E. Thermolite-12 curing catalyst.
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature, atmospheric pressure to 450 psig.

- (1) Company Practices
 - (a) Centrifugal Oxygen Compressors. Used only at the bearing area of centrifugal oxygen compressor case halves where there is a continuous exposure to oxygen leaks through labyrinth seals.

- 1. Company Practices
 - a. Company Research
 - (1) Brophy, M., R&D High Pressure Oxygen Compatibility Test. R&D Notebook #111, p. 149, Jan. 1963, (Doc. #99000137). Ignition was obtained only with the sample in direct contact with the ignition wire at 100 and 2000 psi.



I. Material Compatibility

- A. Plastics, Elastomers, and Adhesives
 - 1. Keene Binder
 - a. Specific Oxygen Environment

No direct exposure to gaseous or liquid oxygen exists in normal use excepting where leakage from process system is possible or breaks in the insulation permit liquefaction of air on cold surfaces then the exposure is to gaseous and liquid oxygen at -297°F and atmospheric pressure or oxygen enriched gaseous or liquid air at temperatures below -297°F and atmospheric pressure.

(1) Company Practices

- (a) An inorganic cement type binder used as an adhesive for sealing joints between cellular glass foam line insulating material.
- (b) APCI Safety Standard 609.1, page 5, June 1964, (Doc. #99000051).

B. Information Sources

- 1. Company Practices
 - a. Company Research

It is believed that this material was tested for flammability, however no test records could be found.



- I. Material Compatibility
 - A. Plastics, Elastomers, and Adhesives
 - 1. Kel-F 81
 - a. Specific Oxygen Environment

Gaseous oxygen ambient temperature pressures to 3000 psig.

- (1) Company Practices
 - (a) Regulator seats
 - (b) Selected cylinder valve seats
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Walde, R. A., "Kel-F High Pressure Oxygen Compatibility,", May 17, 1963, (Doc. #99000132). The Kel-F in these tests was shreded giving results which were not in agreement with results of other testing agencies.
 - c. Based on Research and Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen,"

 MTP-P&VE-M-63-14, p. 45, December 4, 1963,

 (Doc. #99000128).



I. Material Compatibility

- A. Plastics, Elastomers, and Adhesives
 - 1. Nylon
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature, pressures to 3000 psig.

(1) Company Practices

Nylon is not entirely compatible in oxygen service, gaseous and liquid. However successful performance history with relatively few failures in the past 25 years is the reason why nylon continues to be used in high pressure oxygen service to 3000 psig as cylinder valve seats and regulator seats.

- (a) H.P. regulator seats
- (b) Oxygen cylinder valve seats
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Yoder, L., Analytical Report on Ignition Temperature in 100% oxygen Atmosphere, 60-496, Jan. 6, 1961. (Doc. #99000133).
 - (2) Walde, R. A., "Kel-F High Pressure Oxygen Compatibility", May 17, 1963, (Doc. #99000132). Comparison tests with Kel-F.
 - b. Company Operating Experience.

Nylon is not entirely compatible in oxygen service, gaseous and liquid. However successful performance history with relatively few failures in the past 25 years is the reason why nylon continues to be used in high pressure oxygen service to 3000 psig as cylinder valve seats and regulator seats.



I. Material Compatibility

- A. Plastics, Elastomers, and Adhesives
 - 1. Neoprene
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature, pressures to 3000 psig.

(1) Company Practices.

Neoprene is not entirely compatible in oxygen service, however satisfactory performance over last 25 years permits neoprene to remain in low pressure oxygen service. Its principal use is in oxygen regulators where the exposure is to normally less than 50 psig oxygen.

- (a) Regulator safety valve stem seats
- (b) Regulator diaphragms with neoprene molded on brass parts.
- (c) "0" rings
- (d) High pressure seats in two stage regulators.

- Company Practices
 - b. Company Operating Experience.
 - (1) Neoprene is not entirely compatible in oxygen service, however satisfactory performance over last 25 years permits noeprene to remain in low pressure oxygen service. Its principal use is in oxygen regulators where the exposure is to normally less than 50 psig oxygen.
 - c. Based on Research & Development of Others.
 - (1) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III," NASA TM X-53533, p. 31, November 3, 1966, (Doc. #99000125).
 - (2) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV," NASA TM X-53773, p. 25, August 23, 1968, (Doc. #99000126).

I. Material Compatibility

- A. Plastics, Elastomers, and Adhesives
 - 1. Viton A, duPont
 - a. Specific Oxygen Environment

Gaseous oxygen ambient temperature to 160°F, pressures to 250 psig.

- (1) Company Practices
 - (a) Soft seating faces of butterfly valves in oxygen compressor systems.

- 1. Company Practices
 - a. Company Research
 - (1) Brophy, M., "Safety Tests Under WO 81-0095", April 27, 1966. (Doc. #99000135). Oxygen bomb tests to 250 psig. Hylomar Unward Jointing compound SQ-32 was rejected under the same test.
 - (2) Frederick, L. G., and D. R. Latshaw, Oxygen Index Rating Viton O-Ring Material, Viton E-60 (Green), Viton A (Black), Garlock 900 Johns Manville Asbestos 61 Sheet, APCI Analytical Report 71-344, APCI Analytical Report 71-345, August 13, 1971 (Doc. #99000304).
 - (3) Nissler, K. H., Demag KA-27-IV/KA-4-IV Oxygen Compressor Viton A (Black), Viton E-60 (Green), Demag Letter to APCI, August 11, 1971 (Doc. #99000305).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 58, December 4, 1963, (Doc. #99000128).
 - (2) Key, C. F. NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III," NASA TM X-53533, p. 38, November 3, 1966, (Doc. # 99000125).



- I. Material Compatibility
 - A. Plastic, Elastomers and Adhesives
 - 1. Nylon 66' (I.C.I. Limited, U.K.)
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature, pressures up to 3000 psig.

- (1) Company Practices (APL)
 - (a) H.P. Regulator Seats
 - (b) Oxygen Cylinder Valve Seats



I. Material Compatibility

- A. Gaskets and Packings
 - 1. Graphite Impregnated Asbestos Packing.
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, atmospheric pressure to 3000 psig.

- (1) Company Practices
 - (a) Packing for high pressure reciprocating liquid oxygen pumps
 - (b) Stem packing for various valves in oxygen service.

- 1. Company Practices
 - a. Company Research
 - (1) Ball, W.L., "Combustible Contaminant Content in Graphite Impregnated Asbestos Packing." Sept. 30, 1960., (Doc. #99000144).

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LIQUID AND GASEOUS OXYGEN SAFETY REVIEW DATA

- I. Material Compatibility
 - A. Gaskets and Packings
 - 1. TFE-GF-Green, Melrath Gaskets Co.
 - a. Specific Oxygen Environment

Liquid oxygen -297°F. Pressures to 250 psig.

- (1) Company Practices
 - (a) Gaskets in LOX transfer hose connections
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Kitson, F., "Flammability Test of Gaskets in Oxygen Atmospheres," Oct. 23, 1970, (Doc. #99000146).

 Material glowed and charred but did not burst into flame.
 - b. Company Operating Experience.
 - (1) This material similar to Fluorogreen E-600.



- I. Material Compatibility
 - A. Gaskets and Packings
 - 1. Vallegreen, Valley Forge Gasket Co.
 - a. Specific Oxygen Environment
 Liquid oxygen, -297°F, pressures to 250 psig.
 - (1) Company Practices
 - (a) Gaskets in LOX transfer hose connections
 - B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Kitson, F., "Flammability Test of Gaskets in Oxygen Atmospheres," Oct. 23, 1970, (Doc. #99000146).

 Material glowed and charred but did not burst into flame.
 - b. Company Operating Experience.
 - (1) This material similar to Fluorogreen E-600.



- I. Material Compatibility
 - A. Gaskets and Packings
 - 1. Fluorogreen E-600, John Dore Company
 - a. Specific Oxygen Environment

Liquid Oxygen, -297°F, Pressures to 250 psig.

- (1) Company Practices
 - (a) Gaskets in LOX transfer hose connections.
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Kitson, F., "Flammability Test of Gaskets in Oxygen Atmospheres," Oct. 23, 1970, (Doc. #99000146).

 Material glowed and charred but did not burst into flame.
 - c. Based on Research & Development of Others.
 - (1) Key, C.F., and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 62, December 4, 1963, (Doc. #99000128).



- I. Material Compatibility
 - A. Gaskets and Packings
 - Melrath 150 -- sheet asbestos gasket material, Melrath Gasket Co.
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen ambient temperature to -297°F, Pressures to 250 psig.

- (1) Company Practices
 - (a) Flange gasket connections on oxygen vaporizers
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Frederick, L. G., Analytical Report on the Compatibility of Melrath Material with Oxygen, 70-026, January 30, 1970. (Doc. #99000141).
 - b. Company Operating Experience.

As an alternate for Garlock 900.



I. Material Compatibility

- A. Gaskets and Packings
 - 1. KM226 Sheet asbestos gasket material, Nicolet Industries Inc.
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen ambient temperature to -297°F Pressures to 250 psig.

- (1) Company Practices
 - (a) Flange gasket connections on oxygen vaporizers.
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Frederick, L. G., Analytical Report on the Compatibility of Gasket Materials with Oxygen, 70-014, January 30, 1970. (Doc. #99000142).
 - b. Company Operating Experience.

As an alternate for Garlock 900.



I. Material Compatibility

- A. Gaskets and Packings
 - 1. Garlock 900, sheet asbestos gasket material, Garlock Mfg. Co.
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, 160°F to -297°F, pressures to 600 psig.

- (1) Company Practices
 - (a) Most flange gaskets in air separation plants and in oxygen lines.

B. Information Sources

- 1. Company Practices
 - a. Company Research
 - (1) Frederick, L. G., Analytical Report on the Compatibility of Gasket Materials with Oxygen, 70-013, January 30, 1970, (Doc. #99000141 or 99000142).
 - (2) Frederick, L. G., and D. R. Latshaw, Oxygen Index Rating Viton O-Ring Material, Viton E-60 (Green), Viton A (Black), Garlock 900 Johns Manville Asbestos 61 Sheet, APCI Analytical Report 71-344, APCI Analytical Report 71-345, August 13, 1971 (Doc. #99000304).
 - (3) Nissler, K. H., Demag KA-27-IV/KA-4-IV Oxygen Compressor Viton A (Black), Viton E-60 (Green), Demag Letter to APCI, August 11, 1971 (Doc. #99000305).
 - (4) Frederick, L. G., and D. R. Latshaw, Compatibility of Material with Oxygen, Johns Manville Asbestos Sheet Packing Stype No. 61, Garlock 900, APCI IWO LB-0795, APCI Analytical Report 71-264, May 28, 1971 (Doc. #99000309).
 - (5) Robinson, G. W., APCI LOX Compatible Gasket Materials, Garlock 900 Durabla Johns-Manville Asbestos Sheet Packing Style 61, APCI Memo dated June 2, 1971 (Doc. #99000310).
 - b. Company Operating Experiences.

The gasket is not completely compatible with oxygen, however, 25 years of incident free successful service warrants its use in low risk applications.

(1) Key, C. F., and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 62, December 4, 1963, (Doc. #99000128).



I. Material Compatibility

- A. Gaskets and Packings
 - 1. Vulcanized Red Fibre Gaskets
 - a. Specific Oxygen Environment

Exposure is to air at ambient temperature and atmospheric pressure excepting if leak in system develops, then exposure is to gaseous oxygen at ambient temperature and atmospheric pressure.

- (1) Company Practices
 - (a) Oxygen cylinder valve part not exposed to oxygen except on failure of system.

B. Information Sources

- 1. Company Practices
 - a. Company Research

Limited to hydrocarbon analysis for hazard evaluation.

(1) Moysan, S. R., Analytical Report on Qualitative and Quantitative Oil Analysis, 63-1662, 63-1663, November 6, 1963, (Doc. #99000143).



- I. Material Compatibility
 - A. Gaskets and Packings
 - 1. KM246 sheet asbestos gasket material Nicolet Industries
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen ambient temperature to -297°F, Pressures to 250 psig.

- (1) Company Practices
 - (a) Flange gasket connections on oxygen vaporizers
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Frederick, L. G., Analytical Report on the Compatibility of Gasket Materials with Oxygen, 70-015, January 30, 1970, (Doc. #99000142).
 - b. Company Operating Experience.

As an alternate for Garlock 900.



I. Material Compatibility

- A. Gaskets and Packings
 - 1. Teflon, duPont
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, 100°F to -297°F, pressures to 3000 psig.

- (1) Company Practices
 - (a) Oxygen cylinder valve and manifold shut-off valve stem packing.
 - (b) Stem packing in various valves in oxygen production compression, distribution, and control systems.
 - (c) APL Engineering Specification L.14, Rev. 0, July 8, 1969 (Doc. #99000377).

B. Information Sources

- 1. Company Practices
 - a. Company Research

The evaluation of teflon tape applies to packing material as well.

- (1) Dinan, E., Jan. 28, 1959. (Doc. #99000111). Permacel Ribbon Dope, is Item 3.
- (2) Yoder, L., Analytical Report on % Hydrocarbon Contaminant, 61-3, Jan. 16, 1961, (Doc. #99000116).
- (3) Walde, R. A., "Gaseous Oxygen Compatibility of Crosslite Fluorocarbon Tape" July 30, 1963, (Doc. #99000113). Permacel Tape was compared to Crosslite Tape and 3M Fluorocarbon Tape.

- (4) Geist, J. M., Controlled Kinetics Experimentation -- Teflon Hose, APCI MAR 87-0-8820, May 1960 (Doc. #99000057).
- (5) Geist, J. M., Controlled Kinetics Experiments —
 Teflon Hoses, Supported by Braided Stainless Steel
 Housing, and Rubber Hoses, Plasite No 7122H, APCI
 MAR 87-0-8820, June 1960, (Doc. #99000058).
- c. Based on Research & Development of Others.
- (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen,"

 MTP-P&VE-M-63-14, p. 54, December 4, 1963,

 (Doc. #99000128).



I. Material Compatibility

- A. Gaskets and Packings
 - 1. Viton A, duPont
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature to 160°F, pressures to 250 psig.

- (1) Company Practices
 - (a) Flange gaskets for piping systems
 - (b) "0" ring packings for valves

- 1. Company Practices
 - a. Company Research
 - (1) Brophy, M., "Safety Tests Under W081-0095" April 27, 1966. (Doc. #99000135). Oxygen bomb tests to 250 psig.
 - (2) Frederick, L. G., and D. R. Latshaw, Oxygen Index Rating Viton O-Ring Material, Viton E-60 (Green), Viton A (BLack), Garlock 900 Johns Manville Asbestos 61 Sheet, APCI Analytical Report 71-344, APCI Analytical Report 71-345, August 13, 1971 (Doc. #99000304).
 - (3) Nissler, K. H., Demag KA-27-IV/KA-4-IV Oxygen Compressor Viton A (Black), Viton E-60 (Green), Demag Letter to APCI, August 11, 1971 (Doc. #99000305).
 - c. Based on Research & Development of Others.
 - (1) Key, C.F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 58, December 4, 1963, (Doc. #99000128).
 - (2) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III," NASA TM X-53533, p. 38, November 3, 1966, (Doc. #99000125).



- I. Material Compatibility
 - A. Gaskets and Packing
 - 1. Sindanyo. CS 51 Asbestos and Cement Boards. Natural untreated finish (Turners Asbestos Cement Co. Ltd. U.K.).
 - a. Specific Oxygen Environment

Normal exposure is to air or nitrogen, but may be exposed to gaseous or liquid oxygen at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices (APL)
 - (a) Cold Pipe Support Insulating and Packing material.



- I. Material Compatibility
 - A. Gaskets and Packing
 - 1. Klingerit 661 (Richard Klinger Limited U.K.)
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen systems, 160°F to -297°F and pressures up to 600 psig.

- (1) Company Practices (APL)
 - (a) All flange gaskets in air separation plants and in oxygen lines



- I. Material Compatibility
 - A. Gaskets and Packing
 - 1. Tygaflor cementable PTFE tapes (Tygadure Limited U.K.).
 - a. Specific Oxygen Environment

Normal exposure is to air, but may be exposed to gaseous or liquid oxygen at ambient temperature to -297°F and atmospheric pressure in the event of a process leak.

- (1) Company Practices (APL).
 - (a) APL have used these tapes to provide a low friction joint between two metallic faces of a penetration plate so that pipe stresses could be minimized.

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Tarset Pittsburgh Chemical Co.
 - a. Specific Oxygen Environment

Exposure is to air excepting where leakage from system occurs. Exposure is then to gaseous oxygen at ambient temperature and atmospheric pressure.

- (1) Company Practices
 - (a) Underground transmission line coating.
 - (b) APCI Safety Standard 609.1, p. 3, June 1964, (Doc. #99000051).
 - (c) This is an alternate coating material to Plasite.

- 1. Company Practices
 - a. Company Research
 - (1) Brophy, M., R&D Tarset Burning Tests, R&D Notebook #111, p. 129-132, July 1962, (Doc. #99000149).
 - (2) Brophy, M., R&D Pipe Burning Tests, R&D Notebook #111, p. 26-29, April 1961, (Doc. #99000148).
 - (3) Foster, R. H., Safety Hazards, and Explosion Testing, APCI Monthly Activities Report, 87-0-8821, July 1962, (Doc. #99000070).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Sealfas Mastic #31-97, Benjamin Foster Co.
 - a. Specific Oxygen Environment

Exposure is to air excepting where leakage from process system occurs. Exposure then is to gaseous or liquid oxygen, ambient temperature to -297°F, and atmospheric pressure.

- (1) Company Practices
 - (a) A sealant for thermal insulation on product transmission lines operating at a temperature below the liquefaction temp. of air.
 - (b) APCI Safety Standard 609.1, p. 5, June 1964, (Doc. #99000051).

- 1. Company Practices
 - a. Company Research
 - (1) Yoder, L., Analytical Report on Flammability in 100% gaseous oxygen, 61-38, 61-39, Feb. 3, 1961, (Doc. #99000130).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 37, December 4, 1963, (Doc. #99000128).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Plasite, No. 7122H, Wisconsin Protective Coating Co.
 - a. Specific Oxygen Environment

Exposure is to air excepting where leakage from process system occurs. Exposure then is to gaseous or liquid oxygen, ambient temperature to -297°F, and atmospheric pressure.

- (1) Company Practices
 - (a) Underground transmission line coating.
 - (b) Above ground insulated transmission line coating.
 - (c) APCI Safety Standards 609.1, p. 3, June 1964, (Doc. #99000051).

- 1. Company Practices
 - a. Company Research
 - (1) Brophy, M. "Plasite Protective Coating," June 9, 1960, (Doc. #99000150). Corrosion resistance and flammability of coated surfaces tests.
 - (2) Geist, J. M., Controlled Kinetics Experiments —
 Teflon Hoses, Supported by Braided Stainless Steel
 Housing, and Rubber Hoses, Plasite No. 7122H, APCI
 MAR 87-0-8820, June 1960, (Doc. #99000058).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Copper Pipe ASTM B42
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressure to 3000 psig

- (1) Company Practices
 - (a) Various components of oxygen plant piping systems, and instrument systems.
 - (b) Design Engineering Standard 574.1, p. 3, May 1962, (Doc. #99000161).

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 12, January 15, 1963, (Doc. #99000152).
 - (2) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 14, February 1, 1966, (Doc. #99000153).
 - (3) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Copper tube ASTM B75
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to $-297^{\circ}F$, pressures to 2300 psig.

- (1) Company Practices
 - (a) Interconnecting pipe systems in oxygen plants
 - (b) Design Engineering Standard 574.1, May 1962, (Doc. #99000161).
 - (c) Design Engineering Standard 574.2, Jan. 1964, (Doc. #99000162).
 - (d) Design Engineering Standard 574.10, Jan. 1964, (Doc. #99000163).
 - (e) Design Engineering Standard 574.50, Nov. 1968, (Doc. #99000164).
 - (f) Design Engineering Standard 574.51, Nov. 1968, (Doc. #99000165).
 - (g) Design Engineering Standard 574.52, April 1967, (Doc. #99000166).
 - (h) Design Engineering Standard 574.54, Jan. 1964, (Doc. #99000167).

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 12, January 15, 1963, (Doc. #99000152).

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- (2) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 14, February 1, 1966, (Doc. #99000153).
- (3) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1.Red Brass Pipe ASTM B43
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature, pressures to 3000 psig.

- (1) Company Practices
 - (a) Piping headers for gaseous oxygen filling and discharging cylinder manifolds.
 - (b) Design Engineering Standard 572.1, p. 1, May, 1962, (Doc. 99000151).

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
 - (2) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 14, February 1, 1966, (Doc. #99000153).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Aluminum ASTM B211 2024-T4
 - a. Specific Oxygen Environment

Exposure is to air excepting where leakage from process system occurs. Exposure then is to gaseous or liquid oxygen, ambient temperature to -297°F, and atmospheric pressure.

- (1) Company Practices
 - (a) Flange bolting and studs.
 - (b) Design Engineering Standard 571.2, Nov. 1967, (Doc. #99000156).
 - (c) Design Engineering Standard 571.3, Nov. 1967, (Doc. #99000157).
 - (d) Design Engineering Standard 571.4, Nov. 1967, (Doc. #99000158).
 - (e) The references listed below in most tests for compatibility list aluminum without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 66, 67, December 4, 1963, (Doc. #99000128).

- (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 12, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Aluminum, ASTM B 210 3003
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 900 psig.

- (1) Company Practices
 - (a) Straight aluminum instrument tubing, 3/8" O.D. x .035" wall, ASTM 3003-H14.
 - (b) Coiled aluminum instrument tubing, 3/8" O.D. x .035" wall, ASTM 3003-0.
 - (c) Design Engineering Standard 571.50, Nov. 1968, (Doc. #99000159).
 - (d) Design Engineering Standard 571.51, Nov. 1968, (Doc. #99000160).
 - (e) The references listed below in most tests for compatibility list aluminum without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 66, 67, December 4, 1963, (Doc. #99000128).

- (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 12, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Aluminum ASTM B209 5083-0
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 150 psig.

- (1) Company Practices
 - (a) Plant piping sizes 14" through 36"
 - (b) Fittings for pipe sizes 14" through 36"
 - (c) Design Engineering Standard 571.2, Oct. 1965, (Doc. #99000155).
 - (d) Design Engineering Standard 571.3, Nov. 1967, (Doc. #99000156).
 - (e) The references listed below in most tests for compatibility list aluminum without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 66, 67, December 4, 1963, (Doc. #99000128).

- (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 12, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Aluminum, ASTM B210 6061-T6
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 900 psig.

- (1) Company Practices
 - (a) Instrument tubing 3/8" O.D. x .065" wall is mandatory for analyzer taps.
 - (b) Design Engineering Standard 571.50, Nov. 1968, (Doc. #99000159).
 - (c) Design Engineering Standard 571.51, Nov. 1968, (Doc. #99000160).
 - (d) The references listed below in most tests for compatibility list aluminum without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - 1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen,"
 MTP-P&VE-M-63-14, p. 66, 67, December 4, 1963,
 (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).

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IA6a-10 (Continued)

- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 12, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Aluminum ASTM B241 6061-T6
 - a. Specific Oxygen Environment

Gas and liquid oxygen, ambient temperature to -297°F, pressures to 300 psig.

- (1) Company Practices
 - (a) Piping systems to 12" diameter
 - (b) Design Engineering Standard 571.3, November 1967, (Doc. #99000157).
 - (c) Design Engineering Standard 571.4, November 1967, (Doc. #99000158).
 - (d) The references listed below in most tests for compatibility list aluminum without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 66, 67, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).



IA6a-ll (continued)

- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 12, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Aluminum ASTM B247 6061-T6
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 3000 psig.

- (1) Company Practices
 - (a) Anodized body, bonnet, and backcaps of regulators to 3000 psig.
 - (b) Forged flanges for interconnecting plant aluminum piping to 300 psig.
 - (c) Forged fittings for interconnecting plant aluminum piping to 300 psig.
 - (d) Design Engineering Standard 571.2, November 1967, (Doc. #99000156).
 - (e) Design Engineering Standard 571.3, November 1967, (Doc. #99000157).
 - (f) Design Engineering Standard 571.4, November 1967, (Doc. #99000158).
 - (g) The references listed below in most tests for compatibility list aluminum without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 66, 67, December 4, 1963, (Doc. #99000128).

- (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 12, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Aluminum B361 WP6061-T6
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 300 psig

- (1) Company Practices
 - (a) Wrought butt weld fittings to 12 in. pipe size for plant piping systems.
 - (b) Design Engineering Standard 571.3, November 1967, (Doc. #99000157).
 - (c) Design Engineering Standard 571.4, November 1967, (Doc. #99000158).
 - (d) The references listed below for most tests for compatibility list aluminum without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 66, 67, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).

- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 12, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Carbon Steel (Oxygen Service)
 - a. Specific Oxygen Environment

Gaseous oxygen, -20°F to 100°F, pressures to about 3000 psig.

- (1) Company Practices
 - (a) Transmission lines and interconnecting piping using ASTM A53, A53GrB, A134GrA, A135GrA, A245GrA, or A283GrA material.
 - (b) Fittings for transmission lines using ASTM Al05Gr2 and A234 WPB or WPA material
 - (c) Gaseous oxygen cylinders of D.O.T. specified steels at pressures to 3000 psig and temperatures of -20°F to 130°F.
 - (d) Safety relief valve springs in cold gas service at ambient temperatures down to -320°F and pressures to 160 psig.
 - (e) Design Engineering Standard 578.10.1, Oct. 1965, (Doc. #99000168).
 - (f) Design Engineering Standard 578.10.2, Oct. 1966, (Doc. #99000169).
 - (g) Design Engineering Standard 578.10.3, June 1962, (Doc. #99000170).
 - (h) Design Engineering Standard 578.10.4, Jan. 1964, (Doc. #99000171).
 - (i) Design Engineering Standard 578.10.5, Jan. 1964, (Doc. #99000172).
 - (j) Design Engineering Standard 578.10.6, June 1962, (Doc. #99000173).
 - (k) Design Engineering Standard 578.60.3, Sept. 1969, (Doc. #99000030).



- (1) Design Engineering Standard 578.60.4, Sept. 1969 (Doc. #99000031).
- (m) Design Engineering Standard 578.60.5, Sept. 1969, (Doc. #99000032).
- (n) Design Engineering Standard 578.60.6, Sept. 1969, (Doc. #99000033).
- (o) The references listed below in most tests for compatibility list steel or steel alloys without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

B. Information Sources

1. Company Practices

- a. Company Research
 - (1) Foster, R. H., "Cold Test of 1/2" Safety Valve with Carbon Steel Spring, W.O. #10-7071, Project 00-5-3246-51.12" Technical Memorandum No. 79, April 27, 1965, (Doc. #99000185).
 - (2) Kehat, E., "Burning of Steel Pipes in a Flowing Oxygen Stream." April 17, 1961, (Doc. #99000186).
 - (3) Bailey, B., "Ignition Limits of Carbon Steel in Oxygen-Nitrogen Atmospheres", IWO LB-0043, APCI Technical Memorandum No. 112, May 8, 1968, (Doc. #99000187).
- c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).



- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 921, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless Steel ASTM A312 TP304
 - a. Specific Oxygen Environment

Gaseous and Liquid Oxygen, ambient temperature to -297°F pressures to 3000 psig.

- (1) Company Practices
 - (a) Piping systems at oxygen compressors as dictated by conditions of installation
 - (b) Instrument piping above 1500 psig
 - (c) Lubricating oil piping in bearing areas of centrifugal oxygen compressors. Exposure is to air excepting where leakage from system occurs.
 - (d) Design Engineering Standard 578.30.1, May 1962, (Doc. #99000174).
 - (e) Design Engineering Standard 578.30.2, November 1967, (Doc. #99000175).
 - (f) Design Engineering Standard 578.30.3, November 1967, (Doc. #99000176).
 - (g) Design Engineering Standard 578.30.4, January 1964, (Doc. #99000177).
 - (h) Design Engineering Standard 578.30.5, January 1964, (Doc. #99000178).
 - (i) Design Engineering Standard 578.30.6, January 1964, (Doc. #99000179).
 - (j) Design Engineering Standard 578.30.8, January 1964, (Doc. #99000180).
 - (k) Design Engineering Standard 578.30.15, November 1967, (Doc. #99000181).
 - (1) Design Engineering Standard 578.40.1, September 1969, (Doc. #99000182).

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(m) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
 - (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
 - (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 921, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless Steel ASTM A240 304
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F pressures to 3000 psig

- (1) Company Practices
 - (a) Inner vessel of cryogenic storage tanks, highway tankers and railroad tankers.
 - (b) Structural support members of internal components of air separation plant cold boxes.

 Exposure is to air or inert gas excepting where leaks in system occur.
 - (c) Medium pressure liquid oxygen dewars.
 - (d) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).



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- (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 921, July 1961, (Doc. #99000154).

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless Steel ASTM A403 WP304 and A403 WP304L.
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 3000 psig

- (1) Company Practices
 - (a) Wrought stainless fittings for piping systems.
 - (b) Design Engineering Standard 578.30.1, May 1962, (Doc. #99000174).
 - (c) Design Engineering Standard 578.30.2, November 1967, (Doc. #99000175).
 - (d) Design Engineering Standard 578.30.3, November 1967, (Doc. #99000176).
 - (e) Design Engineering Standard 578.30.4, January 1964, (Doc. #99000177).
 - (f) Design Engineering Standard 578.30.5, January 1964, (Doc. #99000178).
 - (g) Design Engineering Standard 578.30.6, January 1964, (Doc. #99000179).
 - (h) Design Engineering Standard 578.30.8, January 1964, (Doc. #99000180).
 - (i) Design Engineering Standard 578.30.15, November 1967, (Doc. #99000181).
 - (j) Design Engineering Standard 578.40.1, September 1969, (Doc. #99000182).
 - (k) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
 - (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
 - (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 921, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless steel ASTM A320 B8304
 - a. Specific Oxygen Environment

Exposure is to air excepting where leakage from system occurs. Exposure then is to gaseous or liquid oxygen, ambient temperature to -297°F, and atmospheric pressure.

- (1) Company Practices
 - (a) Bolting and studs used with forged flanges in piping systems for liquid and gaseous oxygen.
 - (b) Design Engineering Standard 578.30.1, May 1962, (Doc. #99000174).
 - (c) Design Engineering Standard 578.30.2, November 1967, (Doc. #99000175).
 - (d) Design Engineering Standard 578.30.3, November 1967, (Doc. #99000176).
 - (e) Design Engineering Standard 578.30.4, January 1964, (Doc. #99000177).
 - (f) Design Engineering Standard 578.30.5, January 1964, (Doc. #99000178).
 - (g) Design Engineering Standard 578.30.6, January 1964, (Doc. #99000179).
 - (h) Design Engineering Standard 578.30.8, January 1964, (Doc. #99000180).
 - (i) Design Engineering Standard 578.30.15, November 1967, (Doc. #99000181).
 - (j) Design Engineering Standard 578.40.1, September 1969, (Doc. #99000182).
 - (k) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

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- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
 - (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
 - (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 926, July 1961, (Doc. #99000154).

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless Steel ASTM A194 8T321
 - a. Specific Oxygen Environment
 - (1) Company Practices
 - (a) Flange nuts in piping systems for liquid and gaseous oxygen.
 - (b) Design Engineering Standard 578.30.1, May 1962, (Doc. #99000174).
 - (c) Design Engineering Standard 578.30.2, November 1967, (Doc. #99000175).
 - (d) Design Engineering Standard 578.30.3, November 1967, (Doc. #99000176).
 - (e) Design Engineering Standard 578.30.4, January 1964, (Doc. #99000177).
 - (f) Design Engineering Standard 578.30.5, January 1964, (Doc. #99000178).
 - (g) Design Engineering Standard 578.30.6, January 1964, (Doc. #99000179).
 - (h) Design Engineering Standard 578.30.8, January 1964, (Doc. #99000180).
 - (i) Design Engineering Standard 578.30.15, November 1967, (Doc. #99000181).
 - (j) Design Engineering Standard 578.40.1, September 1969, (Doc. #99000182).
 - (k) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

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- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
 - (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
 - (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 921, July 1961, (Doc. #99000154).

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless steels, type 416 cadmium plated
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperature, pressure to 3000 psig.

- (1) Company Practices
 - (a) Oxygen cylinder valve stem tang.
 - (b) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
 - (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
 - (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 921, July 1961, (Doc. #99000154).

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless Steel ASTM A182 F 304 and ASTM A182 F 316
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 3000 psig.

- (1) Company Practices
 - (a) Forged fittings for piping systems.
 - (b) Tube adaptors in instrument piping service
 - (c) Design Engineering Standard 578.30.1, May 1962, (Doc. #99000174).
 - (d) Design Engineering Standard 578.30.2, November 1967, (Doc. #99000175).
 - (e) Design Engineering Standard 578.30.3, November 1967, (Doc. #99000176).
 - (f) Design Engineering Standard 578.30.4, January 1964, (Doc. #99000177).
 - (g) Design Engineering Standard 578.30.5, January 1964, (Doc. #99000178).
 - (h) Design Engineering Standard 578.30.6, January 1964, (Doc. #99000179).
 - (i) Design Engineering Standard 578.30.8, January 1964, (Doc. #99000180).
 - (j) Design Engineering Standard 578.30.15, November 1967, (Doc. #99000181).
 - (k) Design Engineering Standard 578.40.1, September 1969, (Doc. #99000182).
 - (1) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
 - (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
 - (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless Steel, type 304, unidentified as to ASTM spec.
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 3000 psig.

- (1) Company Practices
 - (a) Sintered filters, high pressure oxygen regulators
 - (b) Springs, nozzles, stems, pins, and seat retainers in oxygen regulators.
 - (c) Shafts, rods, and specific parts for reciprocating and centrifugal oxygen pumps and compressors.
 - (d) Forged and cast stainless steel valve bodies
 - (e) Forged, cast, and machined stainless steel valve trim.
 - (f) Bourdon tubes in special gauges.
 - (g) Design Engineering Standard 578.60.1, p. 2, April 1971, (Doc. #99000028).
 - (h) Design Engineering Standard 531.2, p. 3, Oct. 1963, (Doc. #99000022).
 - (i) Design Engineering Standard 579.31., May 1964, (Doc. #99000034).
 - (j) Design Engineering Standard 579.15, August 1966, (Doc. #99000037).
 - (k) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
 - (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
 - (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Copper-Silicon ASTM B98GrB
 - a. Specific Oxygen Environment

Exposure is to air excepting where leakage from system occurs. Exposure then is to gaseous or liquid oxygen, ambient temperature to -297°F, and atmospheric pressure.

- (1) Company Practices
 - (a) As bonnet bolts, studs, and nuts for various valve bodies or assemblies.
 - (b) The references listed below in most tests for compatibility list metals without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - b. Company Operating Experience
 - (1) Acceptable material through years of successful service.
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, December 4, 1963, (Doc. #99000128).
 - (2) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," NASA TM X-985, August 1964 (Doc. #99000127).
 - (3) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen", NASA TM X-53052, May 26, 1964, (Doc. #99000124).



- (4) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III", NASA TM X-53533, November 3, 1966, (Doc. #99000125).
- (5) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV", NASA TM X-53773, August 23, 1968, (Doc. #99000126).
- (6) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, January 15, 1963, (Doc. #99000152).
- (7) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, February 1, 1966, (Doc. 99000153).
- (8) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Free Machining Brass
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 3000 psig.

- (1) Company Practices
 - (a) Regulator inlet, outlet, gages, and misc. parts.
 - (b) Oxygen Cyl. valve parts packing nut, stem body, stem pin, plug, safety nut, handwheel nut. Some parts exposed to oxygen only when leak in systems occur.
 - (c) Valve trim.
 - (d) The references listed below in most tests for compatibility list metals without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - b. Company Operating Experience
 - (1) Accepted material through years of successful service.
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, December 4, 1963, (Doc. #99000128).
 - (2) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," NASA TM X-985, August 1964, (Doc. #99000127).

- (3) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen", NASA TM X-53052, May 26, 1964, (Doc. #99000124).
- (4) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, III", NASA TM X-53533, November 3, 1966, (Doc. #99000125).
- (5) Key, C. F., NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen, IV", NASA TM X-53773, August 23, 1968, (Doc. #99000126).
- (6) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, January 15, 1963, (Doc. #99000152).
- (7) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, February 1, 1966, (Doc. 99000153).
- (8) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Beryllium Copper
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 3600 psig

- (1) Company Practices
 - (a) Bourdon tubes in pressure gauges above 800 psig.
 - (b) Rupture discs in oxygen cylinder valves.
 - (c) Inlet and outlet valves on some reciprocating liquid oxygen pumps.
 - (d) Design Engineering Standard 531.2, p. 3, Oct. 1963, (Doc. #99000022).
 - (e) The references listed below in most tests for compatibility list metals without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 67, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).



- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 14, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless Steel ASTM A269 304
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F pressures to 3000 psig.

- (1) Company Practices
 - (a) Tubing in storage vessel piping systems.
 - (b) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000153).

- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Bronze ASTM B61 or B62
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 3000 psig.

- (1) Company Practices
 - (a) Valve bodies and valve trim for pipe line, oxygen compressor, and air separation plants.
 - (b) Sintered bronze filters in regulator inlet connections.
 - (c) Design Engineering Standard 579.3, Jan. 1963, (Doc. #99000183). (Specification for various valves used in systems)
 - (d) The references listed below in most tests for compatibility list metals without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 67, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).

- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 14, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Brass sheet or plate, ASTM B36
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient temperatures, pressures to 1500 psig.

- (1) Company Practices
 - (a) Impingment plates in carbon steel oxygen transmission lines where flow is into the side of a fabricated tee in lines larger than 6" in diameter.
 - (b) Design Engineering Standard 578.60.3, Note 3, September 1969, (Doc. #99000030).
 - (c) The references listed below in most tests for compatibility list metals without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 67, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).



- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 14, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Monel, ASTM B164
 - a. Specific Oxygen Environment

Gaseous or liquid oxygen, ambient temperature to -279°F, pressures to 3000 psig.

- (1) Company Practices
 - (a) Tees used in carbon steel oxygen lines up to 6" in diameter where the flow is into the side port.
 - (b) Piping downstream of some pressure control valves in critical velocity areas.
 - (c) Valve forgings in critical velocity areas of oxygen transmission systems.
 - (d) Reciprocating liquid oxygen pump rods.
 - (e) Suction strainers for oxygen compressors.
 - (f) Valve trim in critical velocity areas of oxygen transmission lines.
 - (g) Design Engineering Standard 578.60.3, Note 3,
 - (h) The references listed below in most tests for compatibility list metals without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - c. Based on Research & Development of Others.

- (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 67, 68, December 4, 1963, (Doc. #99000128).
- (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 14, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).

I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Stainless Steel ASTM A351 Gr CF8
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient temperature to -297°F, pressures to 1500 psig.

- (1) Company Practices
 - (a) Cast stainless steel valve bodies and valve trim in specified applications in oxygen systems.
 - (b) Design Engineering Standard 579.3, Jan. 1963, (Doc. #99000183). (Specification for various valves used in systems.)
 - (c) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

- 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).

- (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).

- I. Material Compatibility
 - A. Metals, alloys, solders, and surface treatments
 - 1. Stainless, 9% Nickel Steel, ASTM A353GB
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen ambient temperature to -297°F, pressures to 250 psig.

- (1) Company Practices
 - (a) Inner vessel of cryogenic liquid storage containers.
 - (b) The references listed below in most tests for compatibility list stainless steel without identifying ASTM number or grades. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.
- B. Information Sources
 - 1. Company Practices
 - a. Company Research
 - (1) Bailey, B., "Ignition Limits of Some Stainless Steels in an Oxygen Atmosphere." Project 00-7-3480-51.00, APCI Technical Memorandum No. 114, (Doc. #99000188).
 - c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).

- (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).
- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Copper Tube ASTM B88
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, ambient Temperature to -297°F, pressures to 900 psig.

- (1) Company Practices
 - (a) Interconnecting pipe systems in oxygen plants
 - (b) Design Engineering Standard 574.1, May 1962, (Doc. #99000161).
 - (c) Design Engineering Standard 574.2, Jan. 1964, (Doc. #99000162).
 - (d) Design Engineering Standard 574.10, Jan. 1964, (Doc. #99000163).
 - (e) Design Engineering Standard 574.50, Nov. 1968 (Doc. #99000164).
 - (f) Design Engineering Standard 574.51, Nov. 1968 (Doc. #99000165).

B. Information Sources

- 1. Company Practices
 - c. Based on Research & Development of Others.
 - (1) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 12, January 15, 1963, (Doc. #99000152).
 - (2) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 14, February 1, 1966, (Doc. 99000153).
 - (3) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).



I. Material Compatibility

- A. Metals, alloys, solders, and surface treatments
 - 1. Carbon Steel (Non Oxygen Service with possible exposure to oxygen).
 - a. Specific Oxygen Environment

Exposure is to air excepting where leakage from system occurs. Exposure is then to gaseous oxygen at ambient temperature and atmospheric pressure.

- (1) Company Practices
 - (a) Flanges of ASTM Al81 Gr 1 material in transmission and piping systems
 - (b) Studs of ASTM Al93 Gr B7 or A307GrB material
 - (c) Nuts of ASTM Al94 GrH material
 - (d) Oxygen regulator adjusting springs and spring buttons.
 - (e) Outer shells of storage tanks and highway tankers of ASTM A7 material
 - (f) Design Engineering Standard 578.10.2, October 1966, (Doc. #99000169).
 - (g) Design Engineering Standard 578.10.3, June 1962, (Doc. #99000170).
 - (h) Design Engineering Standard 578.10.4, January 1964, (Doc. #99000171).
 - (i) Design Engineering Standard 578.10.5, January 1964, (Doc. #99000172).
 - (j) Design Engineering Standard 578.10.6, June 1962, (Doc. #99000173).
 - (k) Design Engineering Standard 578.10.9, June 1962 (Doc. #99000184).
 - (1) Design Engineering Standard 578.60.3, September 1969, (Doc. #99000030).



- (m) Design Engineering Standard 578.60.4, September 1969, (Doc. #99000031).
- (n) Design Engineering Standard 578.60.5, September 1969, (Doc. #99000032).
- (o) Design Engineering Standard 578.60.6, September 1969, (Doc. #99000033).
- (p) The references listed below in most tests for compatibility list steel or steel alloys without identifying ASTM number or grade. However, we interpret the references as being applicable to the various ASTM numbers and grades as a class.

B. Information Sources

1. Company Practices

a. Company Research

- (1) Foster, R. H., "Cold Test of 1/2" Safety Valve with Carbon Steel Spring, W.O. #10-7071, Project 00-5-3246-51.12" Technical Memorandum No. 79, April 27, 1965, (Doc. #99000185).
- (2) Kehat, E., "Burning of Steel Pipes in a Flowing Oxygen Stream." April 17, 1961, (Doc. #99000187).
- (3) Bailey, B., "Ignition Limits of Carbon Steel in Oxygen-Nitrogen Atmospheres", IWO LB-0043, APCI Technical Memorandum No. 112, May 8, 1968, (Doc. #99000187).
- (4) Kehat, E., APCI Safety, Hazards and Explosion Testing Ucon Type Lubricants, Steel Pipes, APCI MAR 87-0-8820, April, 1961 (Doc. #99000059).
- c. Based on Research & Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 69, 70, December 4, 1963, (Doc. #99000128).
 - (2) Jackson, J. D., W. K. Boyd, and P. D. Miller, Defense Metals Information Center, Battelle Memorial Institute, "Reactivity of Metals with Liquid and Gaseous Oxygen," DMIC Memorandum 163, p. 23, January 15, 1963, (Doc. #99000152).



IA6a-33 (continued)

- (3) White, E. L., and J. J. Ward, Defense Metals Information Center, Battelle Memorial Institute, "Ignition of Metals in Oxygen," DMIC Report 224, p. 15, February 1, 1966, (Doc. 99000153).
- (4) Dean, L. E. and W. R. Thompson, Aerojet-General, "Ignition of Metals and Alloys," American Rocket Society Journal, p. 917-923, July 1961, (Doc. #99000154).

- I. Material Compatibility
 - A. Metals, alloys, solders, and surface treatments
 - 1. Spheroidal graphite Iron (Continental standard GGG 38).
 - a. Specific Oxygen Environemnt Gaseous oxygen, ambient to 320°F, pressure up to 600 PSIG
 - (1) Company Practices (APL)
 - (a) High Pressure casing for $\mathbf{0}_2$ Turbo Compressors.
 - (b) Cylinder heads and jackets for High Pressure O2 Reciprocating Compressors.



- I. Material Compatibility
 - A. Metals, alloys, solders, and surface treatments
 - 1. Silver
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient to $320^{\circ}F$ pressures up to 600 PSIG.

- (1) Company Practices (APL)
 - (a) Oxygen turbo compressor labyrinths.



- I. Material Compatibility
 - A. Metals, alloys, solders, and surface treatments
 - Novonox Stainless steel alloy
 To DIN (German National Standards), Composition:
 5% Cr, 17% Ni, 4% Cu, Niobium Stabilizer, balance Fe.
 - a. Specific Oxygen Environment
 Gaseous oxygen, ambient to 320°F, pressures up to 600 PSIG.
 - (1) Company Practices (APL)
 - (a) Oxygen turbo compressor Impellers.



- I. Material Compatibility
 - A. Metals, alloys, solders, and surface treatments
 - Muntz Metal 60/40 Type, Composition: Cu 58 61%,
 Zn 38.5 42%, Pb 0.35 0.9%
 - a. Specific Oxygen Environment

Gaseous oxygen, ambient to $320^{\circ}F$ pressures up to 600 PSIG.

- (1) Company Practices (APL)
 - (a) Oxygen Turbo compressor Cooler tube plates



- I. Material Compatibility
 - A. Metals, alloys, solders, and surface treatments
 - 1. Alpha brass tube Type TCL 100 or DTD 5019
 (Tungum Company Limited U.K.).
 Composition: Copper 86%, Alum. 1.2%, Nickel 1.4%
 Silicon 1.3%, Iron 0.25%, Lead .05%, Tin 0.1%,
 Manganese 0.1%. Total other impurities 0.5%, Zinc
 Remainder.
 - a. Specific Oxygen Environment

Gaseous and liquid oxygen, $100^{\circ}F$ to $-297^{\circ}F$, pressures up to 3000 PSIG.

- (1) Company Practices (APL)
 - (a) Oxygen manifold piping
 - (b) Oxygen bottling facilities
 - (c) Small standard plant cold box piping



I. Material Compatibility

- A. Chemicals, solvents, and miscellaneous
 - 1. 1,1, dichlorothane
 - a. Specific Oxygen Environment

None. Exposure may be to gaseous or liquid oxygen, ambient temperature to -297°F, pressures to 300 psig if solvent is not completely removed from equipment or parts before introducing to oxygen service.

- (1) Company Practices
 - (a) Solvent agent for hydrocarbon decontamination of small parts used in oxygen systems.

B. Information Sources

- 1. Company Practices
 - a. Company Research
 - (1) Kehat, E., "Development of Standard Ignition Test Progress Report -- Project #87-0-8821", dated Jan. 3, 1962, (Doc. #99000136).
 - (2) Bassler, E., "Cleaning for Oxygen Service" Jan. 1960, (Doc. #99000096).



I. Material Compatibility

- A. Chemicals, solvents, and miscellaneous
 - 1. 1,1,1, Trichloroethane
 - a. Specific Oxygen Environment

None. Exposure may be to gaseous or liquid oxygen, ambient temperature to -297°F, pressures to 3000 psi if solvent is not completely removed from equipment or parts before introducing to oxygen service.

- (1) Company Practices
 - (a) Solvent agent for hydrocarbon decontamination of small parts used in oxygen systems.
 - (b) Safety Standard 609.1, page 2, June 1964, (Doc. #99000051).

B. Information Sources

- 1. Company Practices
 - a. Company Practices
 - (1) Kehat, E., "Development of Standard Ignition Test Progress Report -- Project #87-0-8821," dated Jan. 3, 1962, (Doc. #99000136).
 - (2) Bassler, E., "Cleaning for Oxygen Service" Jan. 1960, (Doc. #99000096).
 - c. Based on Research and Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen,"MTP-P&VE-M-63-14, p. 78, December 4, 1963, (Doc. #99000128).



I. Material Compatibility

- A. Chemicals, solvents, and miscellaneous
 - 1. Chloroform
 - a. Specific Oxygen Environment

None. Exposure may be to gaseous or liquid oxygen, ambient temperature to -297°F, pressures to 300 psi if solvent is not completely removed from equipment or parts before introducing to oxygen service.

- (1) Company Practices
 - (a) Solvent agent acceptable for hydrocarbon decontamination of small parts used in oxygen systems.
 - (b) Laboratory applications
- B. Information Sources.
 - 1. Company Practices
 - a. Company Research
 - (1) Kehat, E., "Development of Standard Ignition Test Progress Report -- Project #87-0-8821," dated Jan. 3, 1962, (Doc. #99000136).
 - (2) Bassler, E., "Cleaning for Oxygen Service," Jan. 1960, (Doc. #99000096).
 - c. Based on Research and Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 78, December 4, 1963, (Doc. #99000128).



I. Material Compatibility

- A. Chemicals, solvents, and miscellaneous
 - 1. Carbon Tetrachloride
 - a. Specific Oxygen Environment

None. Exposure may be to gaseous oxygen ambient temperature, and atmospheric pressure if solvent is not completely removed from equipment or parts before introducing to oxygen service.

- (1) Company Practices
 - (a) Use of carbon tetrachloride prohibited in all areas of activity excepting as authorized in certain laboratory applications.
 - (b) Safety Gram No. 68, Carbon Tetrachloride, Feb. 21, 1969, (Doc. #99000106).

B. Information Sources

- 1. Company Practices
 - a. Company Research
 - (1) Kehat, E., "Development of Standard Ignition Test Progress Report -- Project #87-0-8821," dated Jan. 3, 1962, (Doc. #99000136).
 - (2) Bassler, E., "Cleaning for Oxygen Service" Jan. 1960, (Doc. #99000096).
 - c. Based on Research and Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen," MTP-P&VE-M-63-14, p. 78, December 4, 1963, (Doc. #99000128).



I. Material Compatibility

- A. Chemicals, solvents, and miscellaneous
 - 1. Trichloroethylene
 - a. Specific Oxygen Environment

None. Exposure may be to gaseous or liquid oxygen, ambient temperature to -297°F, pressures to 3000 psig if solvent is not completely removed from equipment or parts before introducing to oxygen service.

- (1) Company Practices
 - (a) Solvent agent for hydrocarbon decontamination of small parts used in oxygen systems.
 - (b) Safety Standard 609.1, page 2, June 1964. (Doc. # 99000051).
- B. Information Sources.
 - 1. Company Practices
 - a. Company Research
 - (1) Kehat, E., "Development of Standard Ignition Test Progress Report -- Project #87-0-8821," dated Jan. 3, 1962, (Doc. #99000136).
 - (2) Bassler, E., "Cleaning for Oxygen Service" Jan. 1960, (Doc. #99000096).
 - c. Based on Research and Development of Others.
 - (1) Key, C. F. and W. A. Riehl, NASA-GCMSFC, "Compatibility of Materials with Liquid Oxygen,"
 MTP-P&VE-M-63-14, p. 81, December 4, 1963,
 (Doc. #99000128).



I. Material Compatibility

- A. Chemicals, solvents, and miscellaneous
 - 1. Methylene Chloride
 - a. Specific Oxygen Environment

None. Exposure may be to gaseous or liquid oxygen, ambient temperature to -297°F, pressures to 3000 psi if solvent is not completely removed for equipment or parts before introducing to oxygen service.

- (1) Company Practices
 - (a) Air Separation plant wash-out solvent
 - (b) Solvent agent for decontamination of small parts used in oxygen systems.
 - (c) Safety Standard 609.1, page 2, June 1964, (Doc. #99000051).

B. Information Sources

- 1. Company Practices
 - a. Company Research
 - (1) Kehat, E., "Development of Standard Ignition Test Progress Report -- Project #87-0-8821," dated Jan. 3, 1962, (Doc. #99000136).
 - (2) Bassler, E., "Cleaning for Oxygen Service" Jan. 1960, (Doc. #99000096).



I. Material Compatibility

- B. Compatibility Check
 - 1. Fire Compatibility
 - c. Cleaning Procedures

In the cleaning of commercial cryogenic systems, the primary task is to remove those contaminants (such as oil and grease) which create a hazardous condition when oxygen is present. A secondary consideration is the removal of those contaminants which might interfere with operation. Examples of this latter category are particles of grit which can interfere with valve closure, and water which can plug up equipment as it freezes.

Before a system is put in service, a cleaning step takes place in the blowing out of all lines, valves, and packing glands. Heated, dry oil-free air or nitrogen is used for blowing out. To be dry oil-free air, it has to go through a drier and have a dew point of -40°F. Nitrogen is preferred. Despite all reasonable precautions during original cleaning and fabrication, it is surprising to observe the amount of foreign material which is blown out in this manner.

After equipment has been in operation, periodic cleaning is necessary only if it becomes contaminated with a fuel. Normally, this does not occur, but if inspections or evidence of contamination indicate fuel to be present in an oxygen system, prompt cleaning of operating equipment is mandatory. Industrial frequency of inspection, and cleaning of operating equipment varies from annually to never, if there is no specific cause for suspecting contamination.

I Cleaning Procedures

- A. Company Practices
 - 1. Initial installation-Construction
 - a. Carbon steel pipe 3" and larger
 - (1) Sand blast to remove rust, varnish and mill scale and other foreign matter.
 - (2) Immerse in a solution to provide an alkaline activated coating to the surface of the work to act as a temporary rust inhibitor.



- b. Carbon steel pipe 2 1/2" and smaller
 - (1) Immerse in a hot solution with a stripper additive to remove varnish and initiate action on rust and scale.
 - (2) Remove pipe thoroughly rinse with water.
 - (3) Immerse again in a hot solution to assure complete removal of rust and scale.
 - (4) Remove pipe from cleaning solution and rinse with water.
 - (5) Immerse in a solution to provide an alkaline activated coating to the surface of the work to act as a temporary rust inhibitor.
- c. Carbon steel pipelines
 - (1) Pipe must be supplied with no interior varnish.
 - (2) Temporary spool pieces and cleaning stations are used to permit specified in place cleaning and inspection.
 - (3) The interior of all pipe is sand blast cleaned in place by the Klean Kote Inc. method
 (Kleane Kote Inc. P.O.
 Box 588, LaPorte, Texas).
 - (4) The pipe is blown out with dry, oil free air or nitrogen after it is blast cleaned.
- d. Aluminum, stainless steel, and copper pipe
 - (1) Immerse in the proper hot solution and allow to soak in solution for a period of time required for complete removal of soils and contaminants.
 - (2) Rinse in water using a high velocity stream.
- e. Fabricated pipe spools after cleaning shall be capped. Pipelines after cleaning are kept under slight positive nitrogen pressure.

2. Existing Installation-Operations

- a. Frequency of cleaning is depending on the following:
 - (1) Periodic inspections when normal preventive



maintenance is scheduled.

- (2) Product sample analysis indicating contaminants.
- (3) Normal schedule as determined from past experience.
- (4) Abnormal operating conditions, such as, high pressure drops, valve seat leakage, etc.

b. Types of Cleaning

(1) Flushing normally used on complex piping circuits. This method is considered the most practical way to clean a cryogenic piping system that has previously been in service.

The piping prior to using the flushing method must be checked to insure that all low points have suitable drains. The high points need vents to completely fill circuits. Double block and bleed valves are necessary where solution could enter an undesirable circuit.

It is first necessary to warm a system prior to flushing. This is done by blowing the system out using 110°F to 150°F nitrogen or dry oil-free air until the insulation and piping are warm, and then use 90°F nitrogen or dry oil-free air to insure that the whole system is not warmer than 90°F. Normally all relief valves and instrument lines are removed and valves are installed to control flow.

Flushing will require a suitable pump for introducing and recirculating the cleaning solution. Although experience has proven that recirculation is not entirely necessary, it is preferred. If it is not possible to recirculate the solution, it is necessary to allow the solution to remain in the system for one hour. The solution when drained, will be replaced with fresh solvent if appreciably discolored, and reintroduced in the system for another soak. When using the soak or recirculating procedure, it must be kept in mind that all circuits must be



completely filled with solution.

Air Products and Chemicals uses methylene chloride for flushing solution. Samples are used to determine the magnitude of contamination. Samples of unused and used solution are gathered for comparison analysis. The quantity of solution introduced along with the quantity that is drained must be recorded to get an indication of how much solution is left in the system. Then other means such as pressurization are used to remove the remaining solution. The total contamination level is based on the sample analysis and the quantity of solution introduced in the system.

The circuits are again blown out after the cleaning solution has been drained. When methylene chloride is used, the circuits are heated to 150°F. and held at this temperature for approximately four hours.

(2) Immersion for small items that are easily accessible.

This method is commonly used as a quick job site emergency method, such as when small parts of a valve are replaced while the system is temporarily shut down. This cleaning usually only requires a clean bucket and a source of nitrogen or dry oilfree air for blowing parts dry.

Methylene chloride or trichlorethylene are the types of cleaning solutions APCI most commonly used for quick cleaning of small parts.

The immersion method is also used extensively for cleaning pipe fittings during initial construction phase. This type of cleaning uses one of the many types of detergent solutions. The type of detergent solution is dependent on the metal to be cleaned.

(3) Spraying or swabbing of large vessels that can be entered.

Surfaces may be sprayed with cleaning solution



applied by pressure spray nozzles. This method is used for cleaning tanks when convenient access is available.

Spraying and swabbing is used at times to clean pipes, fittings, and certain parts.

The spraying and swabbing cleaning method can use a chlorinated solvent or a detergent solution depending on the type of metal as well as the size of the aera to be cleaned.

- (4) Vacuuming used to clean out loose particles prior to a more thorough cleaning.
- (5) Blow-out most commonly used method when dry oil-free air or nitrogen is available.

 Vacuuming and Blow-out method discussion.

Vacuum cleaning loose particles, introduced during fabrication, is used when ready access to the surface is possible.

Inaccessible surfaces on systems and/or circuits may be blown free of solid particles. Sufficient velocity and volume shall be provided to accomplish thorough removal of loose particles from both the system and its outlets. Blow-out using nitrogen or dry oilfree air is done prior to most cleaning procedures. It is also used after cleaning with solutions to remove all traces of solvents or detergents that could not be drained. In most blow-outs, the nitrogen or air is heat-to about 10-50°F above the boiling point of the cleaning solution, to assist in complete derime of system.

(6) Vapor cleaning - this is a commercial method requiring special equipment.

Small items may be cleaned in commercial vapor cleaning equipment. Assemblies which contain removable parts shall be disassembled for vapor cleaning.

This type of cleaning is used commonly by suppliers of parts for oxygen compressors, pumps, valves, etc. This cleaning procedure will supply APCI AAA standard cleanliness. (1,2)



c. Degree of cleanliness

- (1) APCI Class AA cleanliness (3,4) is for fixed surfaces that come in contact with pure oxygen. It will meet the following requirements.
 - (a) Visual examination of the direct surface under strong white light shall indicate: no mositure, slag, organic material, or other foreign material, and essentially no corrosion products.
 - (b) Particulate matter will not exceed 1000 microns and will amount to less than 10 particles between 500 and 1000 microns.
 - (c) Black light examination shall indicate no hydrocarbon fluorescence. Isolated particles of lint may be acceptable.
 - (d) A wipe test, shall show no appreciable discoloration and no evidence of oily residue.
- (2) Class AAA cleanliness (1,2) is for movable parts such as valves, pumps, etc. that come in direct contact with pure oxygen. Requirements are the same as for Class AA with the following additions:
 - (a) Particulate contamination will be limited to 500 microns with not more than 25 particles between 175 and 500 microns.
 - (b) Isolated particles of lint detected by black light must be removed with nitrogen or dry oil-free air.

3. Types of Cleaning Solution

a. Detergents:

(1) Soil and Oil Removal:

(a) Ferrous metals (including stainless steel, invar, and nine-nickel)

#77 Oakite
J.S.T.C. Johar
#4 Johar (low foaming)



(b) Aluminum and Aluminum Alloys

#77 Oakite
J.S.T.C. Johar
#4 Johar

(2) Rust and Scale Removal

(a) Ferrous Metals

#32 Oakite (Hydrochloric base)
Oakite Rust Stripper (Removes paint
 and varnish)
#13 Johar

(b) All Metals

#31 Oakite (removes oxides and fluxes)
#23 Johar

(3) Deoxidizer and Brightener

(a) Aluminum and Copper

#34M Oakite (Chromic base) #22 Johan

(4) Rust Retardant

(a) All Metals

Rinsite (also prevents water spotting)

(5) Corrosion Stain Removal

(a) Aluminum and Aluminum Alloys

#160 Oakite (etching material) rinses freely
#21 Johar

Detergent solutions shall not be employed to clean a surface which, through use, will contact oxygen rich atmospheres, unless the cleaned surface can definitely be determined as free of all cleaning solution after rinse.

b. Chlorinated Solvents

(1) Removal of oil, grease, fats, waxes, tar, rubber, sulfur, and resins.



(a) All Metals

Trichlorethylene (conforming to Federal specifications 0-1-634A, Type II, and Military Specification MIL-T-7003)

Methylene Chloride (technical grade)

It removes grease, oil solvent residue, lubricating compounds. In addition, its solvent activity permits quick stripping of paint and lacquer films, including latex and the new tough epoxy resin materials.

Equipment cleaned with chlorinated solvents shall be purged with clean, dry air or nitrogen. The purge shall continue until the exhaust can be determined free of solvent vapors when tested with Halogen gas detection equipment.

When ordering, specify inhibited grades of solvent to prevent acidic action on metals where water or water vapors are present. Also, specify that the solvent is for metal cleaning of equipment in oxygen service and that the maximum residue permitted on evaporation is only 0.001% by weight. When drums of solvent are ordered, it is good to specify that all be from the same lot number. This will permit easier and more accurate sampling.

II APCI Experiences and Analysis of Cleaning

A. LOX Tanks

1. Case 1 - Date 1959

Tanks inspected and cleaned after 1-1/2 years of operation. Two tanks were cleaned at this



facility. Tank No. 1 had three pounds of dust containing 2.8% by weight of hydrocarbons which ignited in oxygen at 598°F. Tank No. 2 contained 1-1/2 pounds of dust. Small globules of contaminants outlined a liquid level. These tanks have inlet and outlet nozzles on the same end. Tank capacity is 27,000 gallons.

2. Case 2 - Date 1960

Tanks inspected and cleaned after three years of service. Five gallons of dust were removed, but no definite traces of hydrocarbons were found. No lab analysis is available. Tank capacity is 27,000 gallons with inlet and outlet nozzles on the same end.

3. Case 3 - Date 1960

Tanks inspected and cleaned after two years of service. Three pints of dust were removed. Dust residue was found on all surfaces. Fluorescence under black light in form of rings at liquid levels. (Cases 1, 2, 3 from memo dated 1/24/63 from H. H. Master to J. M. Norwood(5)).

4. Case 4 - Date 1963

Tanks inspected and cleaned after 3-1/2 years of service. The tank was washed down with solvent. Analysis of the solvent used indicated a total of 2.125 grams of hydrocarbons which, averaged out on the complete tank surface, would have been about .7 milligrams of hydrocarbons per square foot. This tank is not of the flow-through type and it is cylindrical. Tank capacity is 28,000 gallons. (Memo dated June 26, 1970 from H. H. Master to W. L. Ball (6)).

5. Case 5 - Date 1964

Tanks cleaned after three years of service. The surface of the tank was clean with no visible traces of oil or other hydrocarbons. However, six pounds of extremely fine silica gel were removed from the tank. The analysis of the silica gel indicated 0.6% by weight to be hydrocarbons. This calculates to 0.04 pounds of



IBlc-l (continued)

hydrocarbons in the tank. This tank was fed by anyone of six plants at one time or other. The tank capacity is 27,000 gallons and is of the cylindrical type. This tank prior to inspection and cleaning was what is called a deadended tank, that is, with the inlet and outlet nozzles being on the same end of the tank. Piping was changed to make it a flow-through tank. (Memo dated 3/11/64 from A. L. Hatley to R. S. Ray (7)).

The tanks listed are all filled from air separation units. All cases other than case 4, are filled from high pressure cycle plants using expansion engine in series with turbo expanders. Case 4 is fed from a split cycle plant. The time tanks were put in service is known, but the throughput of the tank is not known and cannot be estimated because all these locations have more than one tank. A tank in service for one year could have had more throughput than one is service two years.

There are no firm cleaning schedules for liquid tanks. The air separation units are defrosted and blown out on a three year schedule. Should the defrost indicate an unusually high contamination, tank cleaning would be mandatory.

B. Liquid Oxygen Pumps

1. Case 1

Inspected and cleaned after 15,000 hours of operation. Contaminants: 1.29 gr. Pump showed some dust and no visible oil.

2. Case 2

Inspected and cleaned after 2,250 hours of operation. Contaminants: 1.90 gr. Pump showed some dust and no visible oil.



3. Case 3

Inspected and cleaned after an estimated 2,000 hours. Contaminants: 11.1 gr. Pump was black lighted with negative results. No traces of dust reported.

4. Case 4

Inspected and cleaned after 3,100 hours of operation. Contaminants: 3.17 gr. Pump showed some dust and no visible oil.

5. Case 5

Inspected and cleaned after 2,191 hours of operation. Contaminants: 0.34 gr. Pump showed some dust and no visible oil.

In all cases the contaminants were usually assumed to be the same as the lubricant used in the air compressor.

The above mentioned pumps take suction from air separation units. The suction to the pumps has a 100 mesh screen. Cleaning frequencies depend on the type of cycle of the air separation unit as well as past history. Frequencies range from 24 months to 36 months. In newer plants with cleaner cycles (using centrifugal compressors), cleaning is done only if contamination is suspected.

C. Miscellaneous Equipment

Liquid oxygen dump tanks, disposal vaporizers, product vaporizers, and vent stacks are cleaned on a five year maximum interval cycle.

1. Case 1 - 1964

A LOX vaporizer was cleaned after 15 months of service during which a total of 542,486 SCF oxygen was vaporized. The flushing with recirculation method was used. The cleaning solution was methylene chloride. The hydrocarbon contamination analysis showed 0.1056 grams. The contamination accumulating in the vaporizer is negligible as was expected. (Memo from F. K. Kitson to J. J. Mittleman July 1964 (8)).



- (1) APCI Class AAA Cleanliness Requirements
 APCI Quality Control Layout No. QCL 107F, July 1, 1971
 (Doc. #99000082)
- (2) APCI Requirements for Vendor Class AAA Cleaning APCI Quality Control Layout No. QCL 117F, July 1, 1971 (Doc. #99000086)
- (3) APCI Class AA Cleanliness Requirements
 APCI Quality Control Layout No. QCL 106F, July 1,
 1971 (Doc. #99000081)
- (4) APCI Requirements for Vendor Class AA Cleaning APCI Quality Control Layout No. QCL 116F, July 1, 1971 (Doc. #99000085)
- (5) Master, H. H., Storage Tank Cleaning APCI Memo, January 24, 1963 (Doc. #99000089)
- (6) Master, H. H., LOX Tanks
 APCI Memo, June 26, 1970 (Doc. #99000091)
- (7) Hatley, A. L., Cleaning LOX Storage Tank No. 6 Santa Susana
 APCI Memo, March 11, 1964 (Doc. #99000090)
- (8) Kitson, F. K., Washout Analysis of Sun Oil Company's LOX Tank Vaporizer

 APCI Memo, July 9, 1964 (Doc. #99000092)
- (9) APCI Cleaning Requirements for Air Plant Equipment APCI Quality Control Layout No. QCL 101F, July 1, 1971 (Doc. #99000077)
- (10) APCI Cleaning Requirements for Bourdon Tube Type Gages Used for Oxygen Service

 APCI Quality Control Layout No. QCL 102F, July 1, 1971 (Doc. #99000078)
- (11) APCI Approved Cleaning Agents and Associated Equipment and Supplies

 APCI Quality Control Layout No. QCL 103F, December 14, 1965 (Doc. #99000285)
- (12) APCI Class A Cleanliness Requirements
 APCI Quality Control Layout No. QCL 105F, July 1,
 1971 (Doc. #99000080)
- (13) APCI Requirements for Vendor Class A Cleaning
 APCI Quality Control Layout No. QCL 115F, July 1,
 1971 (Doc. #99000084)



- (14) Pennsalt Chemicals Corporation, Cleaning of Liquefied Gas Processing Equipment Pennsalt Technical Bulletin, February 3, 1960 (Doc. #99000093)
- (15) Kitson, F. K., Cleaning For Oxygen Service APCI Memo, August 5, 1963 (Doc. #99000094)
- (16) APCI Cleaning and Inspection, Materials for Oxygen Service APCI Safety Standards 608.1, October 1965 (Doc. #99000050)
- (17) APCI Cleaning and Inspection for Equipment in Air Plants and in Oxygen Service

 APCI Plant Operations Manual, Section 1.08, April 4, 1967 (Doc. #99000095)
- (18) APCI Piping, Valve Procurement and Cleaning Procedure APCI Design Engineering Standard 579.5, August 12, 1960 (Doc. #99000036)
- (19) Bassler, E. J., Cleaning for Oxygen Service APCI, January 1960 (Doc. #99000096)
- (20) Master, H. H., Air Separation Plant Contamination, History, Sampling and Analysis APCI Plant Managers' Safety Meeting, Creighton, Pa., February 28 and March 20, 1968 (Doc. #99000097)
- (21) APCI Exchanger, Plant, and Plant Equipment Solvent Washout Frequencies

 APCI Plant Operations Manual Section 5.07, July 15, 1970 (Doc. #99000098)
- (22) APCI Plant Solvent Washout, General
 APCI Plant Operations Manual Section 1.05, February 20,
 1967 (Doc. #99000099)
- (23) APCI Byron-Jackson Oxygen Pump Washout Procedure for Analytical Purposes APCI Plant Operations Manual Section 1.07, July 7, 1970 (Doc. #99000286)
- (24) APCI Cleaning
 APCI Construction Specification 230.15, page 8,
 September 16, 1969 (Doc. #99000101)
- (25) APCI Cleaning of Carbon Steel Pipe and Fittings; Cleaning Aluminum Pipe, Fittings, Parts and Fabrications; Cleaning Stainless Steel and Copper Pipe, Fittings, Parts and Fabrications; Description of Cleaning Mediums; Inspection of Decontaminated Components; and Pickling of Carbon Steel Pipe and Fittings

 APCI Construction Specifications 200 16 1.7 to 200.17.4

APCI Construction Specifications 200.16.1.7 to 200.17.4, Pages 14-20, February 3, 1967 (Doc. #99000102)



- (26) Coulson, K. J., and I. Everson, Fire Hazards When Vapor Cleaning With Trichlorethylene (T.C.E.) APL - Safety Department Information Sheet No. 38, February 10, 1971 (Doc. #99000105)
- (27) Schmoyer, W. W., Carbon Tetrachloride

 APCI Safety-Gram No. 68, February 21, 1969 (Doc. #99000106)
- (28) Kehat, E., Detonation Tests of Oil From Aliquippa Pump Suction Filter Defrost and of Methylene Chloride APCI Memo, December 11, 1961 (Doc. #99000107)
- (29) Smith, H., APCI Solvent and Cleaners--Deviations--Cleaning for Oxygen Service

 APCI Safety Standard 629.0.10, June 19, 1961
 (Doc. #99000054)
- (30) Himmelberger, F., Notes on Liquid Oxygen Contaminants
 Missile Program, APCI, January 6, 1958 (Doc. #99000108)



I. Material Compatibility

B. Compatibility Check

1. Fire Compatibility

The cleaning procedures followed by APL are essentially the same as the ones followed by APCI. These procedures and related ones are covered in the following documents:

- (1) APL, Construction Specifications for Piping Erection Testing and Cleaning, APL Engineering Specification M.O2, Rev. 2, April 19, 1971 (Doc. #99000397).
- (2) APL, Solvent Washing of Piping Systems, APL I.G.D. Engineering Manual EM 56-06, Rev. 0, July 3, 1971, (Doc. #99000398).
- (3) APL, General Procedure foe Decontamination of Static Tank and Road Vehicle Assemblies for 0₂ Service, APL Quality Control Procedure No. Q.10. Rev. 0, (Doc. #99000399).
- (4) APL, Manufacturing Quality Procedure for Degreasing of Pipework, APL Quality Control Procedure No. Q.11. Rev. 0, (Doc. #99000400).
- (5) APL, Manufacturing Quality Procedure for Internal Cleaning of Aluminum Tankers and Static Tanks for Oxygen Service, APL Quality Control Procedure No. Q.12. Rev. 0, (Doc. #99000401).
- (6) APL, Manufacturing Quality Procedure for Internal Cleaning of 9% Nickel and Hi-Proof Stainless Static Tanks for Oxygen Service, APL Quality Control Procedure No. Q.13, Rev. 0, (Doc. #99000402).
- (7) APL, Aloclene 100 and Applied Chemicals 5.57, APL, February 5, 1972, (Doc. #99000403).



- I. Material Compatibility
 - B. Compatibility Checks
 - 1. Fire Compatibility
 - d. Quality Control
 - (1) Fire Hazards
 - (a) procedures
 - (b) specification

Machining and fabrication controls to reduce ignition and fire hazards involve primarily the cleaning of accessible and inaccessible surfaces prior to or after assembly.

Machined parts constituting rotating or moving pieces are cleaned (after machining) of sulfurized machining lubricants in accord with APCI Class AAA Cleanliness Requirements, Quality Control Layout, QCL107F, Jul 1971 (Doc. #99000082).

This is usually accomplished by immersing in agitated solvent solutions, such as methylene chloride solution. (Refer Pecklam, H. M., and Hauser, R. L., The Martin Company, "Compatibility of Materials with Liquid Oxygen", proceedings of the 1958 Cryogenic Engineering Conference, Advances in Cryogenic Engineering, Vol. 4, Paper A-3, p. 26-46, Plenum Press, Inc. (N.Y.), January 1959 (Doc. #99000189).

Fixed machinery parts are clenaed in a similar manner under slightly less stringent inspection conditions to APCI Class AA Cleanliness Requirements, Quality Control Layout, QCL106F, July 1971 (Doc. #99000081).

Fabrication poses problems on inherent cleanliness in areas such as a) backup strips, b) angle stiffeners, c) cleaning of vessels prior to final closure of the inner vessels, d) brazed aluminum assemblies, e) brazed copper assemblies.

Prior to insertion of weld ring type backup strips in an aluminum or stainless steel piping assembly, the surfaces of both the backing ring and the adjacent pipe are power sanded to a clean bright finish.

Angle stiffeners whose flat edges bear against the plate are fully fillet welded on both sides so that the fayint surfaces are completely encased and never see the product fluid or gas.



Prior to final closure of vessels without manway openings the internals of the vessels are washed with an acceptable solvent and examined to either:

- a) APCI Class B Cleanliness Requirements, Quality Control Layout, QCL104F, July 1971 (Doc. #99000079),
- or b) APCI Class A Cleanliness Requirements, Quality Control Layout, QCL105F, July 1971 (Doc. #99000080),

dependent on the final product, and as indicated in:

APCI Cleaning Requirements for Air Plant Equipment, Quality Control Layout, QCL101F, July 1971 (Doc. #99000077).



- I. Material Compatibility
 - B. Compatibility Checks
 - 1. Fire Compatibility
 - d. Quality Control APCI
 - (2) Programs
 - (a) policies
 - (b) practices

APCI Quality Manual determines cleanliness requirements for all phases of manufacture and for all purchased material and equipment. These requirements are self-explanatory and are covered by the following documents:

- (1) APCI Cleaning Requirements for Air Plant Equipment, Quality Control Layout, QCL101F, July 1971 (Doc. #99000077).
- (2) APCI Cleaning Requirements for Bourdon Tube Type Gages Used for Oxygen Service, Quality Control Layout, QCL102F, July 1971 (Doc. #99000078).
- (3) APCI Class B cleanliness Requirements, Quality Control Layout, QCL104F, July 1971 (Doc. #99000079).
- (4) APCI Class A Cleanliness Requirements, Quality Control Layout, QCL105F, July 1971 (Doc. #99000080).
- (5) APCI Class AA Cleanliness Requirements, Quality Control Layout, QCL106F, July 1971 (Doc. #99000081).
- (6) APCI Class AAA Cleanliness Requirements, Quality Control Layout, QCL107F, July 1971 (Doc. #99000082).
- (7) APCI Requirements for Vendor Class B Cleaning, Quality Control Layout, QCL114F, July 1971 (Doc. #99000083).
- (8) APCI Requirements for Vendor Class A Cleaning, Quality Control Layout, QCL115F, July 1971 (Doc. #99000084).
- (9) APCI Requirements for Vendor Class AA Cleaning, Quality Control Layout, QCL116F, July 1971 (Doc. #99000085).



- (10) APCI Requirements for Vendor Class AAA Cleaning, Quality Control Layout, QCL117F, July 1971 (Doc. #99000086).
- (11) APCI Brazed Aluminum Heat Exchanger Cleaning Requirements, Quality Control Layout, QCL119F, July 1971 (Doc. #99000087).

It should be noted that the brazed aluminum heat exchanger cleaning is performed to remove flux, in particular, and contaminants, in general, in order to protect against corrosion, as well as against ignition and fire hazard.

The following references are of interest in relation to cleaning requirements for oxygen service:

- (1) APCI Requirements for Vendor Class B Cleaning, Quality Control Layout, QCL114F, July 1971 (Doc. #99000083).
- (2) APCI Requirements for Vendor Class A Cleaning, Quality Control Layout, QCL115F, July 1971 (Doc. #99000084).
- (3) APCI Requirements for Vendor Class AA Cleaning, Quality Control Layout, QCL116F, July 1971 (Doc. #99000085).
- (4) APCI Requirements for Vendor Class AAA Cleaning, Quality Control Layout, QCL117F, July 1971 (Doc. #99000086).
- (5) APCI Requirements for IPD Specified Paint Systems, Quality Control Layout, QCL120F, July 1971 (Doc. #99000088).
- (6) Compressed Gas Association, "Equipment Cleaned for Oxygen Service," CGA Pamphlet G-4.1, March 1959 (Doc. #99000198).
- (7) Kehat, E., "Hazard Level of Hydrocarbon Films in Systems Containing Liquid and Gaseous Oxygen," Advances in Cryogenic Engineering, Vol. 1, pp. 163-169, 1962 (Doc. #99000199).
- (8) Ball, W. L., "Hazard Level of Hydrocarbon Films in Oxygen Systems," AICHE-CEP Tech. Manual, Safety in Air and Ammonia Plants, Vol. 4, pp. 16-20, 1962 (Doc. #99000200).
- (9) Walde, R. A., "Relationship of the Chemical Structure of Cutting Oils to Their Oxygen-Compatibility," AIChE-CEP Tech. Manual, Safety in Air and Ammonia Plants, Vol. 7, pp. 21-23, 1965 (Doc. #99000201).
- (10) Lapin, A., Discussion with Mr. E. Lucas-IPD Inspection, Regarding APCI Cleanliness Requirements, APCI Memo, July 22, 1971 (Doc. #99000221).

- (11) Lapin, A., Telephone Conversation with Mr. William McCormick regarding Requirements for Vendor Class AA and Class AAA Cleaning, APCI Memo, July 22, 1971 (Doc. #99000222).
- (12) Kehat, E., "Hazard Level of Hydrocarbon Films in Systems Containing Liquid and Gaseous Oxygen," Cryogenic Engineering Conference, Ann Arbor, Michigan, USAF Contract AF33(616)6730, August 15-17, 1961 (Doc. #99000303).
- (13) Frederick, L. G., D. R. Latshaw, APCI Analytical Report on Fluorescence of Various Types of Oils -- Mobil DTE-105, Texaco Cappella A, Cellulube 550, Fluorolube, Sears Thread Cutting Oil, July 15, 1971 (Doc. #99000311).
- (14) ASTM Standard Pictorial Surface Preparation, ASTM Standards for Painting Steel, ASTM-D2200-67, 1967 (Doc. #99000339).



I. Materials Compatibility

- B. Compatibility Check
 - 1. Fire Compatibility
 - d. Quality Control APL
 - (2) Programs
 - (a) Policies
 - (b) Practices

The following references represent APL practices relative to cleanliness and quality control requirements for equipment used in oxygen service:

- (1) APL, Acceptance Test for Class B Cleanliness, APL Engineering Specification A.Ol, Rev. O, May 12, 1969, (Doc. #99000360).
- (2) APL, Acceptance Test for Class A Cleanliness (High Purity Clean), APL Engineering Specification A.02, Rev. 0, May 12, 1969, (Doc. #99000361).
- (3) APL, Acceptance Test for Class AA Cleanliness (Oxygen Clean), APL Engineering Specification A.O3, Rev. O, April 1, 1971, (Doc. #99000362).
- (4) APL, Degreasing Acceptance Tests for Oxygen Service Compressors, APL Engineering Specification K.O2, Rev. 0, June 23, 1969, (Doc. #99000363).
- (5) APL, Valves Oxygen Service: Minimum Decontamination and Test Requirements, APL Engineering Specification L.06, Rev. 0, July 7, 1969, (Doc. #99000364).
- (6) APL, Construction Specification for Piping Erection, Testing and Cleaning, APL Engineering Specification M.02, Rev. 2, April 19, 1971, (Doc. #99000365).
- (7) APL, Specification for Oxygen Service Vessel Fabrication (Designed by APL Fabrication by Vendor), APL Engineering Specification C.03, Rev. 2, July 26, 1971, (Doc. #99000366).



- (8) APL, Specification for Oxygen Service Pressure Vessel Fabrication (Designed and fabricated by the Vendor), APL Engineering Specification C.04, Rev. 2, July 26, 1971, (Doc. #99000367).
- (9) APL, Brazed Core Extended Surface Heat Exchangers, APL Engineering Specification E.02, Rev. 4, June 28, 1970, (Doc. #99000368).
- (10) APL, Shell & Tube Type Cooler, Other Than for O₂ Service (APL Plants), APL Engineering Specification E.O4, Rev. 1, June 1, 1971, (Doc. #99000369).
- (11) APL, Shell & Tube Type Coolers for 0₂ Service, APL Engineering Specification E.05, Rev. 1, June 1, 1971, (Doc. #99000370).
- (12) APL, Centrifugal Cryogenic Pumps, APL Engineering Specification, G.03, Rev. 0, April 1, 1971, (Doc. #99000371).
- (13) APL, Pressure Gauge Oxygen Service, APL Engineering Specification J.07, Rev. 0, June 18, 1969, (Doc. #99000372).
- (14) APL, Pressure Regulating Valves for Oxygen Service, APL Engineering Specification J.15, Rev. 0, June 18, 1969, (Doc. #99000373).
- (15) APL, Relief Valves, Warm Gas Service, -20°F +100°F, APL Engineering Specification J.18, Rev. 0, June 18, 1969, (Doc. #99000374).
- (16) APL, Transfer Hose for Cryogenic Liquids, APL Engineering Specification L.11, Rev. 0, July 7, 1969, (Doc. #99000375).
- (17) APL, Flexible Hoses for Charging and Discharging Manifolds Oxygen Service, APL Engineering Specification L.12.1, Rev. 0, July 7, 1969, (Doc. #99000376).
- (18) APL, Unsintered P.T.F.E. Tape, APL Engineering Specification L.14, Rev. 0, July 8, 1969, (Doc. #99000377).
- (19) APL, Cryogenic Liquid Hose Couplings for Use in the U.K., APL Engineering Standard LS.08, Rev. 0, October 21, 1969, (Doc. #99000378).
- (20) APL, Expanded Perlite, APL Engineering Specification N.Ol, Rev. 0, January 1, 1970, (Doc. #99000379).
- (21) APL, Mineral Wool, APL Engineering Specification N.02, Rev. 0, January 2, 1970, (Doc. #99000380).
- (22) APL, Insulation Preformed Cellular Glass Section for Pipelines, APL Engineering Specification N.05, Rev. 0, October 1, 1970, (Doc. #99000381).



I. Material Compatibility

B. Compatibility Checks

2. Structural Materials Compatibility

APCI experience with oxygen service has been with both metallic materials, and non metallics for gaskets and packing.

- a. (1) Chemical reactions and alloy modifications due to oxygen diffusion are not known to affect material strength, and therefore are not a factor considered in the selection of metallic materials for oxygen service.
 - (2) Material composition is not a factor, but both mechanical and thermal properties are. The change in mechanical and thermal properties with temperature are considered.
 - (3) Metallurgical changes such as embrittlement at lower temperatures is a factor with all construction materials. However, this is due to the low temperatures produced by cryogens, with no special consideration for oxygen.
 - (4) Coatings and claddings are not factors considered for oxygen service because there is no need for them.
 - (5) Exposure to secondary reagents is not a factor for oxygen service because of a low probability of being exposed to them.
- b. Structures and support systems are designed to safely accomodate the dimensional changes produced by temperature differences between ambient to low temperature operation. This is generally accomplished by providing flexibility between structures to minimize interaction forces.
- c. Notch-sensitivity is a factor in material selection, and is indicated by tests on a notched tensile specimen or by means of a notched-impact specimen. The latter is in general use and is required by the ASME Pressure Vessel Codes (1,2). The notch in the impact specimen represents the stress raiser which may be present in the as-built structure, or developed during subsequent operation. Operating experience indicates that



code rules governing design, material examination, and weld acceptance standards have been sufficient to minimize failures due notch sensitivity.

- d. Fabrication and welding is carried out in accordance with the ASME Pressure Vessel code (1,2) rules with satisfactory results. Inspection meets the National Board requirements (3).
- e. Materials and parts suitability controls are carried out in accordance with the ASME Pressure Vessel Code rules with satisfactory results.
- f. Composite materials have not been used for pressure carrying parts for oxygen service.
- g. As indicated earlier, APCI has had experience with non-metallic valve inserts and butterfly and ball valve seats and seals.

 Kel-F Teflon, and glass-filled Teflon have been satisfactory, particularly for tight shut-off conditions. APCI's Design Engineering Standard 578.60.1 (4) on oxygen piping should give APCI's current practices. This should be an excellent document for describing somewhat completely materials and conceptual requirements. Also the CGA's Oxygen Pipeline Subcommittee rough draft of March 30, 1971, "Assembly of Industrial Practices Used For Gaseous Oxygen Transmission and Distribution" (5), should be a fine reference document.

h. References

- (1) American Society of Mechanical Engineers, Pressure Vessel Division, ASME Boiler and Pressure Vessel Code Section VIII, 1971 (Doc. #99000210).
- (2) American Society of Mechanical Engineers, Welding Qualifications, ASME Boiler and Pressure Vessel Code 1971 (Doc. #99000211).
- (3) National Board Inspection Code, A manual for boiler and pressure vessel inspectors, The National Board of Boiler and Pressure Vessel Inspectors, Columbus, Ohio, 1968 (Doc. #99000212).
- (4) APCI, Oxygen Piping, APCI Design Engineering Standard 578.60.1, April 24, 1972 (Doc. #99000028).
- (5) Compressed Gas Association, Assembly of Industrial Practices Used for Gaseous Oxygen Transmission and Distirbution, CGA Docket 70-11, March 22, 1972 (Doc. #99000345).

I. Material Compatibility

- B. Compatibility Check
 - 2. Structural Materials Compatibility
 - a. Relationship of Material Strength to Maximum Stress Over the Working Temperature Range as Affected by:
 - (1) Chemical reactions and alloy modifications due to oxygen diffusion,
 - and (2) Materials composition and property changes

No consideration is given to the effect of chemical reactions and possible alloy modifications due to oxygen diffusion. Testing of copper tubing and lead-tin solders after ten years of intermittent cryogenic service have given no indication of deterioration of material properties. Stainless steels and aluminum alloy which form inner cryogenic vessels of insulated systems have shown no appreciable deterioration of vacuum after eight-ten years of service and it is felt that appreciable diffusion would be evident in this period of time. It is not considered, on this basis, that significant changes in properties take place in the above alloys. Thermal cycling of highly strain hardened stainless steel under experimental conditions has been found to produce transformation of up to 15% of the normally austentic structure to martensite.

However, no service failures have occurred which can be attributed to these factors.

(3) Metallurgical changes such as embrittlement

No known failures have occurred by any suspected embrittlement phenonenon thought to be associated with oxygen diffusion.

(4) Effects of coatings and claddings

While some fear existed in the early 9% nickel steel vessels that dissimilar weld metal and reinforcement pad material would provide dangerously different expansion coefficients, results of several years' service tend to indicate otherwise. The inconel type filler metals in use as weld metal for the 9% nickel steels have taken part in no field type failures. Similarly, clad material would appear to offer no great disadvantage, providing the properties of both the cladding and the material being clad were compatible with the temperature of operation.



Experimental and service history has been obtained with the Aluminum-Stainless Steel roll bonded transition piece, and the Aluminum-Copper-Stainless Steel brazed transition piece, and the Aluminum-Copper-Stainless Steel brazed transition pieces. Under modest loads, no degradation of bond takes place, even after several hundred cycles from ambient to cryogenic conditions. Similarly, the silver welded alum-stainless steel transition has shown exceptionally good resistance to stresses imposed by cycling.

(5) Compatibility losses through exposure to secondary reagents which are natural to systems or introduced by accidents.

Failures of materials in rich or lean gaseous oxygen service is typified by "wet atmospheres" with traces of chlorides. Upon condensation in the system, an accumulation of chlorides can occur which may seriously affect stainless steels, and the brasses commonly used for condenser tubing, and could cause failure usually by a stress corrosion mechanism. The same conditions on aluminum alloys results in a rather general corrosion pattern.

Improper materials selection or improper protection of materials on the water side of heat exchangers produces galvanic couples which results in premature failures of shells, baffles, etc.



I. Material Compatibility

- B. Compatibility Checks
 - 2. Structural Materials Compatibility
 - c. Notch sensitivity of materials over temperature range of use as affected by:
 - (1) Thermal Fatigue

 No specific information.
 - (2) Allowable defect size (fabrication or material fault)
 - and (3) Allowable crack growth and rate of crack growth

Allowable defect sizes, where measured, have been in accord with ASME Code, Sec. VIII, Para. UW-51, (Doc. #99000210) and its associated porosity standard. No failures have occurred which are attributable to residual defects of this size. Investigations regarding allowable crack growth and rate of crack growth have been non-existent except for some preliminary studies referred to below which show growth of cracks in an aluminum alloy at ambient temperatures under cyclic loads:

Erdogan, F. and R. Roberts, "A Comparative Study of Crack Propagation in Plates Under Extension and Bending" Proceedings of the First International Conference on Fracture, Vol. 1, p. 341-362, 1965 (Doc. #99000213).

Roberts, R. and F. Erdogan, "The Effect of Mean Stress on Fatigue Crack Propagation in Plates Under Extension and Bending," Presented at the ASME Winter Annual Meeting, Pittsburgh, Pa., November 12-17, 1966 No. 67-WA/Met-2 (Doc. #99000214).

Loushin, L. L., W. J. Lambertin, and A. J. Polmer, "An Application of Fracture Mechanics to Safe Life Design in Cryogenic Pressure Vessels", Esso Research and Engineering Company, Report No. EE.26ER.70, August 24, 1970, (Doc. #99000215).

Tafuri, J. C. and R. Roberts, "Fatigue - Crack Growth Rates and Fracture Toughness Study of Welded Aluminum Alloy 5083", Presented at the ASME Winter Annual Meeting, November 29 - December 3, 1970, Paper No. 70-WA/PVP-5 (Doc. #99000216).



- I. Material Compatibility
 - B. Compatibility Checks
 - 2. Structural Materials Compatibility
 - d. Fabrication and Welding (Include guide to material and weld defect repairs).

Material and welding defect repairs are required when defects are more serious than those allowable in ASME Code, Section VIII, Para. UW-51 or UW-52 (Doc. #99000210), (whichever is applicable).

In all cases, the defect is removed by grinding (using aluminum oxide or silicon carbide wheels, high speed burrs, or a file) and the area in question is examined by either a dye penetrant or radiographic technique to insure removal of the defect prior to rewelding. Even with visual and dye penetrant techniques, however, defeat recognition and removal sometimes escapes the operator and repetitive repair welding of the same area is required. In these instances the aluminum alloys tend to over-age, or segregate, and hot cracking of the adjacent parent material can take place. A cure for this condition is sometimes a local annealing or solution treating operation. By the same token, 9% nickel steel impact properties can be seriously affected by repetitive welding operations in a localized area. Stainless Steels are remarkably free of any of the above troubles.

- I. Material Compatibility
 - B. Compatibility Checks
 - 2. Structural Materials Compatibility
 - e. Materials and parts suitability controls
 - (2) Vendor procedures on purchased equipment

Vendor procedures for fabrication are similar to APCI in that the code and cleaning requirements, where imposed, regulate fabrication.



II. Operational Hazards

A. Overpressure

- 1. Safety relief valves are installed in accordance to APCI Piping Group Memo #19 (1).
- Thermal relief valves are always installed in any section of cold piping which lies between two valves.
- 3. Low point drains are generally provided to minimize trapped liquids.
- 4. Refer to Review Forms IIA4-1 and IIA4-2.
- 5. Structural loads on venting systems are determined as per APCI Piping Group Memo #19 (1).
- 6. Piping is designed to ANSI B31.3 "Petroleum Refinery Piping"
 (2) or ANSI B31.5 "Refrigeration Piping" (3) to guard against
 failure from overpressure. For a treatise on failures due to
 defects see: THIELSCH, HELMUT "Defects and Failures in Pressure
 Vessels and Piping" (4) Reinhold.
- 7. Velocities in gaseous oxygen systems are limited to a maximum of 200 feet per second. Surges on pressure waves should be avoided and the piping system designed for what is considered an economical pressure drop.

Flow of liquid should be controlled so there is not a great rate of change in velocities in the system to minimize pressure surges (commonly known as water hammer). Refer to bibliography on Water Hammer (5), for additional information.

B. Cited References

- 1. APCI, Safety Relief Valves, Location and Piping Design Considerations, APCI Piping Group Memo #19, November 3, 1966 (Doc. #99000346).
- 2. ANSI B31.3, Petroleum Refinery Piping, American National Standard Institute (Ex American Standard Association), 1966 (Doc. #99000347).



- 3. ANSI B31.5, Refrigeration Piping, American National Standard Institute (Ex USA Standard), 1966 (Doc. #99000348).
- 4. Thielsch, Helmut, Defects and Failures in Pressure Vessels and Piping, Reinhold Publishing Corporation, New York, 1965 (Doc. #99000349).
- 5. APCI, An Analysis of Water Hammer in Cryogenic Transfer Lines, The Mississippi Test Facility of the George C. Marshall Space Flight Center, National Aeronautics and Space Administration; APCI, February 28, 1964 (Doc. #99000358) (Bibliography p. 86 only).

C. Additional References

- 1. APCI, Pressure Vessels -- Gaseous Oxygen Storage Cylinder, APCI Design Engineering Standard 515.1.3, October 17, 1960 (Doc. #99000016).
- 2. APCI, Pressure Vessels -- Vessel Design Basis and General Standards, APCI Design Engineering Standard 510.1, August 1962 (Doc. #99000018).
- 3. APCI, Pressure Vessels -- Materials of Construction, APCI Design Engineering Standard 510.1.4, June 1962 (Doc. #99000019).
- 4. APCI, Pressure Vessels -- Shell Design, APCI Design Engineering Standard 510.2, February 1965 (Doc. #99000020).
- 5. APCI, Pressure Vessels -- Head Design, APCI Design Engineering Standard 510.3, August 1962 (Doc. #99000021).
- 6. APCI, Instrumentation -- Special Requirements for Safety and Relief Valves, APCI Design Engineering Standard 537.9, July 1965 (Doc. #99000024).
- 7. APCI, Piping -- Extended Bonnet Valve Code, APCI Design Engineering Standard 579.4, April 1963 (Doc. #99000035).
- 8. APCI, Plant Components, Cold Boxes, APCI Safety Standards 607.1.5, January 1963 (Doc. #99000045).
- 9. Kitson, F. K., Rupture Discs Manufactured LOX Tankers by Ametek, APCI Memo, June 22, 1971 (Doc. #99000314).
- 10. Compressed Gas Association, Safety Relief Device Standards PT-3, Compressed Gas Storage Containers, CGA Pamphlet S-1.3, 1966 (Doc. #99000315).



II. Operational Hazards

A. Overpressure

- 4. Integrity of Insulation
 - I. Shop Fabricated LOX Storage Tanks

These tanks are of double wall construction with the annular space filled with Perlite insulation and evacuated to 10 microns pressure. The integrity of the insulation is not affected by the internal pressure of the inner tank except in the case of failure or leakage of the inner tank. To prevent overpressuring of the inner tank, pressure relieving devices are installed using the following design criteria.

- A. Safety Valves are set at 100% design pressure and sized to relieve the largest of the flows listed below.
 - 1. LOX vaporized due to normal heat leak boil-off.
 - 2. Gas volume equal to maximum filling rate (vent valve assumed closed).
 - 3. Maximum gas flow for pressurization valve failure in wide open position.
- B. Rupture disc set at 120% of design pressure and sized to relieve the largest of the flows listed below minus the safety valve capacity.
 - 1. Vessel exposed to fire with Perlite in the annular space but no vacuum. The amount of LOX vaporized is calculated using the equation in paragraph 4.3.5 in CGA Pamphlet S-1.3 Safety Relief Device Standards, Part 3, Compressed Gas Storage Containers (Doc. #99000315).
 - 2. LOX vaporized due to heat leak assuming vacuum is lost in the annular space. Heat leak will increase up to 350 times that of a tank with the design vacuum in the annular space.

The outer tank is protected by a spring loaded lift plate to relieve overpressures above 2-3 psi in the annular space.



II. Operational Hazards

- A. Overpressure
 - 4. Integrity of Insulation
 - II. Field Fabricated, flat bottom LOX Storage Tanks

These tanks are of double wall construction with the annular space filled with Perlite and purged with nitrogen. The integrity of the insulation system on these tanks are affected in the same way as for the shop fabricated tanks (IIA4-1). The pressure relieving devices for the inner tank are sized using the following design criteria.

- A. Pressure Vacuum relief valves are used to protect the inner tank.
 - 1. The pressure setting is 5 psig and the valve is sized to relieve the largest of the operating conditions listed below.
 - a. LOX vaporized due to normal heat leak boiloff plus LOX flashing in tank under filling conditions.
 - b. Relief of gas volume equal to maximum filling rate (vent valve assumed closed)
 - 2. The vacuum setting is 1/2 oz. and the valve is sized for a gas volume equal to maximum pumpout rate.
- B. Pressure Vacuum relief valves are used to protect the outer tank.
 - 1. Pressure setting is 2" H₂0 and valve is sized to relieve the maximum nitrogen purge flow with purge control valve failing wide open or the expansion of the purge gas due to an exterior fire.
 - 2. Vacuum setting is 1" $\rm H_2O$ and valve is sized to handle the variations the annular space gas volume due to ambient thermal cycling.



II. Operational Hazards

B. Disposal of Vented Gases

1. Company Practices

a. Air Plants

Although NASA is not interested in air separation plants in this particular study, our policy of segregating various defrost, disposal and reactivation lines to vent stacks may be applicable to some of their operations. Basically, this is merely an isolation of pure oxygen or oxygen rich vent manifolds and stack from other vents which have or may possibly contain incompatible materials. Refer to APCI Safety Standard 607.1.12, Pages 7 and $8^{(1)}$.

h. Safety Valves

Safety valve discharges are piped outdoors where such equipment may be in buildings or confined areas. Safety considerations for the vent area are to include adequate ventilation to prevent oxygen concentrations or hazards to personnel. Personnel hazards would include flammability possibilities, cryogenic burns and harmful effects of high velocity gases directed on individuals.

Safety valve discharges can be manifolded and extended to a safe area providing the piping manifold is sized to prevent excessive back pressure on the valves which would effect the relief setting. Cases have been considered on individual basis whereby individual safety valve discharge vents or manifolded systems are tied into the proper defrost, disposal or reactivation stacks (mentioned above) to extend discharges to a safe or safer distance without duplicating long piping runs. All manifold valves must be piped properly, including unions on the discharge piping, so they can be removed for repair, replacement or checks.

Safety discharges must be protected from weather and other possible adverse effects. If discharges are not manifolded, they must have an elbow facing downward (but not in areas frequented by personnel) in the discharge part or have a pipe nipple with the bottom outboard end cut off at a 45° angle.

Further details are in Safety Standard 607.1.12⁽¹⁾ and Design Engineering Standard 578.60.1⁽²⁾.



IIB-1 (Continued)

c. Product Loading Areas

Operations Department has installed systems in loading areas where gas vented from highway tankers being filled can be a hazard to operators, equipment and in some cases to third parties where the activities are located reasonably close to public thoroughfares, to handle these vented gases. Climatic conditions (little or no wind velocity, high humidity, etc.) can increase the hazards as vapors tend to remain in the area and close to the ground.

-2-

These systems consist of a flexible hose attachment on the tanker vent which connects to a manifold piped to a 500-gallon aluminum tank. A vent stack off the top of the tank extends from 20 feet to 30 feet above grade depending on the location and magnitude of the problem. The primary purpose of the 500-gallon tank (92483D)(3) is to act as a "buffer" in the event a tanker is inadvertently permitted to overflow. Secondary purpose is to use it as a dump tank for off-specification liquid or discarding residual liquid in a tanker that is to be converted to another product.

Some refinements to the system, depending again on the location, overall problem and the fact that the loader may not always be in the immediate area, are:

1. An air blower (generally 1700 CFM) is set on the tank and discharges, at an angle, into the stack so as to act as an eductor. This air serves to dilute the gas concentration and also to heat the vapors to prevent their "dropping" to the ground level. Actuation of the blowers varies according to needs. Where frequent service is required it is kept operating, for all practical purposes, constantly. Others turn it on as necessary. A number of locations have a temperature—actuated switch with a sensing bulb in the stack. The temperature switch is set to the lowest temperature practical below that of expected low for the geographical location.



- Level switches (usually set at about 5 inches) are piped into the side of the tank, near the bottom, where loaders may leave the immediate area. This switch is set to actuate an alarm to warn the loader that the tanker is overfilled and passing liquid into this tank. The loader would be expected to get back to the loading pad and immediately shut the fill valve. Where the loader may be an appreciable distance away, the switch would also stop the blower to prevent a possible reaction should the liquid reach the blower dischange before the fill valve is shut. Where the tank is used for disposal of liquid, a by-pass switch may be necessary to take this switch out of the blower and alarm circuits during this operation. A red warning shall indicate it is on by-pass and in this case, the loader should not be permitted to leave the area.
- 3. Most facilities have more than one product loaded at the same site. Separate manifolds are used for each product, but they do tie into a common tank. The separate manifolds are to preclude the possibility of reverse flow of one product into another and is particularly important where oxygen may back into a highpurity nitrogen tanker where 25 ppm or less oxygen is standard. The blower-eduction system supplements this control in that its operation tends to clear out all vapors and, depending on the number of simultaneous loadings, may effect a slight negative pressure within the tank. Another back up system for cross contamination is a swing check valve where each tanker ties into the manifold system with the flexible hose. These check valves are on all systems.
 - 4. Storage tank vents, relief valve discharge piping, and pump cooldown lines have been tied into these dispersal system tanks where necessary and convenient.



All new facilities are required to have some dispersal system for trailer vents in load areas. Where multiple usage is practical, the above system need not be incorporated. The Wharton plant has a large capacity dump tank for discharging off-specification liquid during startup periods. This doubles as a trailer load system vent. At Lone Star a product vaporizer (cooling water as a vaporizing medium) has a separate coil for dumping liquid from the hydrocarbon and guard adsorbers when they are to be reactivated. The tanker vapor lines are teed into the circuit, pass through the vaporizer, and go to an existing stack.

We are presently in a program for automating loading systems whereby the shutoff valves are actuated by a liquid level switch on the trailer. For these systems, the dispersal tank with the blower and the level switch are a compulsory part of the automation. In addition to providing safe venting conditions, the system provides a backup for the automation. If the fill valve fails to close on the tanker contained circuitry, the overflow operates the dispersal tank switch which in turn interrupts the power to the fail-close automatic valves and also sounds an alarm and shuts off the blower. The "Auto-Load" systems are described in some detail in H. H. Master's memoranda dated March 22, 1971(4) and April 5, 1971(5).

In addition to direct safety aspects, the trailer venting system has a direct economic advantage in that it reduces the curb stop and pad deterioration caused by cold gases and liquids. Also, accidental spills have resulted in the necessity for tire replacement numerous times and amounts saved in this respect are not calculable but are known to have been high.

d. Disposal Problems

Problems related to the disposal of cryogenic vapors are covered in APCI Safety - Gram No. 17 (6), H. H. Master's paper subject "Product Vapor Hazards"(7), J. B. Gayle's paper subject "Fire Incident in an Oxygen Cloud"(8), and A. Lapin's paper subject "Oxygen Diffusion in the Atmosphere for Liquid Oxygen Pools" (9, 10).

References

- (1) APCI, Air Separation Plant, Piping, Valves and Safety Relief Devices, APCI Safety Standard 607.1.12, October 1962 (Doc. #99000046).
- (2) APCI, Oxygen Piping, APCI Design Engineering Standards 578.60.1, April 27, 1971 (Doc. #99000028).
- (3) APCI, LOX and LIN Vapor Disposal Tanks (500 Gal.), APCI Drawing 92483D, Rev. B, September 30, 1968, (Doc. #99000247).
- (4) Master, H. H., "Lathrop Auto-Load System," APCI Memorandum to W. J. Scharle, March 22, 1971, (Doc. #99000248).
- (5) Master, H. H., "Auto Load Systems," APCI Memorandum to W. J. Scharle, April 5, 1971, (Doc. #93000249).
- (6) APCI, A Misty Problem, APCI Safety Gram No. 17, August 10, 1962, (Doc. #99000250.)
- (7) Master, H. H., "Product Vapor Hazards," APCI (Doc. #99000251).
- (8) Gayle, J. B., "Fire Incident in an Oxygen Cloud," Fire Journal, pages 76-78, 81, Jan. 1971 (Doc. #99000252).
- (9) Lapin, A. and R. H. Foster, "Oxygen Diffusion in the Atmosphere from Liquid Oxygen Pools," Advances in Cryogenic Engineering, Vol. 13, pp. 555-565, 1968 (Doc. #99000599).
- (10) Lapin, A. and R. H. Foster, "Oxygen Diffusion in the Atmosphere from Liquid Oxygen Pools," Compressed Gas Association, Air Separation Plant Safety Symposium, pp. 12-23, Chicago, Illinois, April 23, 1969 (Doc. #99000600).



II. Operational Hazards

- B. Disposal of Vented Gases
 - 1. Cleanliness of disposal system (compatibility with oxidizer).

Report IIB1-2 covers our approach to this question including conformance to Safety Standard 608.1⁽¹⁾. This standard limits particulate size and quantity to an acceptable value to prevent plugging of operating equipment and to eliminate particle friction as a source of ignition. Additionally, these values are acceptable for most commercial applications involving control valves, orifices, etc.

Materials utilized in disposal and vent systems are limited to corrosion resistant types such as copper, brass, austenitic stain-less steel and monel. Objective here is to maintain the cleanliness level originally achieved while utilizing materials suitable for cryogenic temperatures. Design Engineering Standard 578.60.1 reflects this philosophy.

2. Proximity of other activities to vents which may be endangered by oxidizers, dilution methods for safe concentrations.

Our basic philosophy is to vent far enough away from personnel areas or operating equipment to permit natural dilution to safe limits. Distances are indicated by following standards:

Vents from oxygen compressors Vaporizer vents

Vaporizers are designed to vent cold gas. Vent piping must be directed away from carbon steel components to prevent cooling below -20°F.

Relative locations of vents drains and defrost stacks are covered by Safety Standards 605.1.3(4), Air Separation Plant Layout.

3. References.

- (1) APCI Cleaning and Inspection, Materials, Oxygen Service, APCI Safety Standards 608.1, October 1965 (Doc. #99000050).
- (2) APCI Oxygen Piping, APCI Design Engineering Standards 578.60.1, April 24, 1972 (Doc. #99000028).



- (3) Kitson, F., APCI, Plant Components, Air Separation Plant, Piping, Valves and Safety Relief Devices, APCI Safety Standards 607.1.12, October, 1962 (Doc. #99000046).
- (4) Ball, W. L., Criteria Air Separation Plant Layout, APCI Safety Standards 603.1.3, January 6, 1961 (Doc. #99000043).



II. Operational Hazards

- B. Disposal of Vented Gases
 - l. Cleanliness

The approach to cleanliness of oxygen piping is covered in detail in APCI Construction Specifications. A typical example would be the APCI Construction Specifications, General Construction and Equipment Erection, Oxygen Compression System, El Segundo, Calif. Section 200.0 to 200.20, Revised November 17, 1969 (Doc. #99000338). Additional requirements are found in APCI, Cleaning and Inspection of Materials in Oxygen Service, APCI Safety Standards 608.1, October 1965 (Doc. #99000050).



II. Operational Hazards

- B. Disposal of Vented Gases
 - 4. Procedural arrangements

APCI criteria for the design of oxygen piping are covered by APCI Design Engineering Standards 578.60.1 for oxygen piping dated April 27, 1971 (Doc. #99000028).

II. Operational Hazards

- C. Coupling to Other Systems
 - Isolation arrangements for keeping oxidizers out of adjacent systems; considerations of operational errors or leaks through valves.

Leakage of oxygen to nitrogen is normally prevented by use of double check valves (Circle Seal series 232B with Viton 0-ring seals) located between manual double block valves (ball type with Teflon seals). The chamber between the block valves is vented to the atmosphere through a vent valve and check valve. The check valve is utilized to prevent entrance of contaminants during extended periods when the vent valve is open.

Where nitrogen gas is utilized for purging hydrocarbon systems and the gas originates in a vessel common to the oxygen (distillation column), a special isolation system is utilized to prevent backflow of hydrocarbons into the oxygen column in case nitrogen pressure diminishes below normal levels. Automatic double block valves are utilized with an automatic vent valve between them. Actuation is by loss in pressure or loss of nitrogen purity.

Accidental contamination of oxygen piping and instruments with oil is normally prevented by segregated piping and instrumentation so that oil leakage cannot occur around oxygen containing components.

2. Temperature coupling to adjacent systems; cooling, cold condensate, leakage of cool liquids on adjacent systems.

Basically, we normally employ stainless, aluminum and copper for the portion of systems operating below -20°F and for warmer piping up to an alarm switch set to warn operator of falling temperatures below -5°F. Thereafter, carbon steel is usually utilized unless maintaining cleanliness during construction or during operation is a problem.

Compressors, which are vulnerable to liquid carryover from a liquid source, are protected by a liquid trap in addition to a temperature alarm and shutdown systems.



II. Operational Hazards

D. Spills and Leakage

The general rule is to repair oxygen gas or liquid leaks immediately. If leaks are minor and in a relatively safe area, and it is not practical to fix them immediately they would be fixed at the first opportune moment. For bad leaks in hazardous areas, of course, the leak is to be fixed immediately. Minor leaks where there is a real potential hazard, such as a cracked fitting which could break completely, would be repaired immediately.

No leaks are to be repaired until all pressure in the appropriate circuits has been bled down. When torches or welding are necessary for repairs, circuits must be purged with nitrogen and tested for 21% oxygen or less atmospheres. Also, hot work requires positive blank of source of oxygen. Positive blanks include complete disconnect of line by mechanical means, blank inserted between flanges, or two block valves with a bleed to atmosphere between them. Naturally, all tools and fittings should be cleaned appropriately before use and the area should be cleaned and dried after work has been completed.

Our main area of concern regarding spills is in the load-unload areas. There have been a number of major spills, generally due to truck pulling out before disconnecting the transfer hose. All of the newer facilities have remote operated shutoff valve on storage tank lines in the event there is line breakage. Older plants are under investigation and no decisions have been made in this matter. Presently there are 31 LOX tanks in this load-unload category, ll of which have remote shut off valves. There have been a number of incidents where drivers have pulled away and torn up our loading area lines. However, all were caught and handled immediately so no major incidents resulted. Generally, the manual valve was closed and damage repaired as necessary. One such recent happening was at a location where they had a remote valve but this was on a LIN system.

The majority of our loading areas have water deluge systems installed, manually actuated, which would serve to vaporize spilled liquid and at least prevent propagation of a fire in the event we had such a problem. Details are in APCI "Deluge System LOX Loading Facility", Safety Standard 630.2.6, Jan. 1964 (Doc. #99000055).



APCI, "Check List, Air Separation Plant, Operation", Safety Standard 610.1.5, February 16, 1961 (Doc. #99000218), has two items on the check list regarding spill hazards. One (Page 10) indicates the loading area pad is to be sloped to permit flow to the least hazardous area. The other (Page 9) questions, "Are there remote operating shutoff valves at locations where large quantities of LOX or liquid hydrogen are stored and failure of a tank would present an extreme hazard?"

APCI, "Air Separation Plant, Cryogenic Liquid Disposal", April 1962 (Doc. #99000047), and APCI, "Vaporizer, Cryogenic Liquid Disposal", Design Engineering Standard 514.6.2, May 26, 1961 (Doc. #99000015), are not directly applicable to spills and leakage but have some details on vaporizers and natural disposal.

We have not environmental warning and escape systems, therefore no detection; quantity and response time limits.

It is company and industry policy to keep all oxygen areas and systems free of incompatible materials and ignition sources.

"Handling of Low Temperature Fluids and High Pressure Oxygen", by F. Himmelberger, presented at the Aeronautical Industries Section Program of the National Safety Congress, Chicago, Ill., October 19, 1959 (Doc. #99000219), has some material on spills. All facilities have this article included in their Safety Manuals.



II. Operational Hazards

- D. Spills and Leakage
 - 1. Drainage and Ultimate Disposal Arrangements
 - At production plants the Industrial Gas Division is responsible for the conversion of transport equipment from one service to another (e.g. LOX to LIN) and for disposal of off-purity product. This general category of disposal would be intentional and would be performed in the following manner if the production facility has a vapor collection system. The liquid product would be transferred at a controlled rate into the plant tanker vapor collection system for vaporization and dispersal through a vent stack provided with a blower which safely disperses the vapor into the atmosphere. If a vapor collection system is not provided at the production facility, the liquid product is drained onto a clean gravel area at a controlled rate to avoid producing a large vapor plume and a large area with a high oxygen concentration.
 - Safe venting and control of leakage during transfer of LOX product at consumer sites is achieved by eliminating the possibility of product from contacting combustible materials. It is IGD practice to install bulk oxygen storage systems in accordance with company criteria based on the applicable codes, NFPA #566, "Installation of Bulk Oxygen Systems at Consumer Sites", 1965 edition (Doc. #99000190). This code and Air Products' criteria requires that liquid oxygen be transferred over noncombustible surfaces, thus, any leakage of liquid oxygen or small spillage would be safely vaporized. noncombustible surfaces referenced above are clean gravel or concrete. Where asphaltic paving or possible hydrocarbon on gravel or on earth are under the transfer hose connections or valving, an aluminum drip-pan is provided during the transfer operation. It has been Air Products' experience that the relatively small quantity of vapor associated with LOX transfer procedures do not pose a problem.



NFPA #566, 1965 edition has been revised in May 1971, in accordance with the "Ammendments" to NFPA No. 566, (Doc. #99000191) and will be designated as NFPA #50.

c. Gaseous oxygen storage systems are also covered by NFPA pamphlet #566; however, the problems of leakage are significantly less than with LOX.



II. Operational Hazards

- D. Spills and Leakage
 - 2. Separation of Incompatible Materials and Ignition Sources in Disposal Systems

NFPA #566 (Doc. #99000190) lists quantity distance criteria to maintain flammable and combustible storage at a safe distance from the oxygen bulk storage system. Similarly, ignition sources are restricted from the immediate area of the oxygen bulk storage system. It is the intent of the NFPA code to prevent storage of combustible materials and combustible structures at an inadequate distance from the storage system to preclude the exposure of the oxygen storage system to a fire.



II. Operational Hazards

- D. Spills and Leakage
 - 3. Environmental Warnings and Escape Systems

Due to the practical maximum storage at consumer sites, perhaps 20,000 gallons of LOX, (average 2,400 gals) there is not a necessity for any specific or general requirements for environmental warnings and escape systems. Each oxygen bulk storage system is placarded with a warning "Oxygen - No Smoking or Open Flames."



II. Operational Hazards

- D. Spills and Leakage
 - 4. Detection: Quantity and Response Time Limits

Due to the practical maximum storage of 20,000 gallons of liquid oxygen with the average storage being 2,400 gals, a detection system is not provided at consumer facilities. NFPA pamphlet #566 (Doc. #99000190) requires that storage systems be located in well ventilated areas and places a restriction on the number of fire walls and locations of fire walls that may be used and would restrict ventilation (see Section 5-1-11).



II. Operational Hazards

E. Contaminants Accumulation

The procedures for solvent evaporation technique, and for extraction of ether soluble material and oil content determination are covered in:

Latshaw, D. R., "Oxygen Safety Review Check List", May 4, 1971 (Doc. #99000217)

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LIQUID AND GASEOUS OXYGEN SAFETY REVIEW DATA

II. Operational Hazards

F. Oxygen Transfer

1. Production to storage, storage to system, storage to transport, transport to system.

Liquid production to storage is normally accomplished through gravity feed to low pressure tanks operating at 2-3 psig. Piping material may be austenitic stainless, copper or aluminum. Insulation is by rockwool in ducts for multiple lines or Foamglas for one or two lines. Liquid oxygen or nitrogen may be carried in a common duct. Inclusion of liquid hydrocarbons is not permitted. Small plants often utilize a vacuum jacketed transfer system or a batch transfer system to minimize heat leakage.

Storage to system often requires elevated pressures necessitating the use of centrifugal pumps. Storage to transport also requires pumping equipment due to operating pressures of the storage and the normal elevation of transport tankers. Transport to system is usually accomplished by pressurizing the tanker (to approximately 25 psig) or by on-board pumps for higher pressures.

Safety requirements relative to storage and loading areas are covered by Standard 607.2.1.1 $^{(1)}$. Deluge systems are covered by Standard 630.2.6 $^{(2)}$.

2. References.

- (1) Ball, W. L., Plant Components, Storage, Converter System, and Cryogenic Liquids, APCI Safety Standards 607.2.1.1, April, 1962 (Doc. #99000048).
- (2) Kitson, F. K., APCI, The Protection Equipment, Deluge System, LOX Loading Facility, APCI Safety Standards 630.2.6, January, 1964 (Doc. #99000055).



II. Operational Hazards

- F. Oxygen Transfer
 - 1. Production, Storage to System, Storage to Transport, Transport to System Loading and Unloading Procedures for Liquid Oxygen Transfer are Listed in Air Products' Safety Standards 635.19, Pages 3, 4, 5, and 6.
 - a. APCI, Loading and Unloading Operations, APCI Safety Standards 635.19, February 1968 (Doc. #99000194).



II. Operational Hazards

F. Oxygen Transfer

1. Systems

Field Fabricated Cryogenic Liquid Storage Tanks.

APCI procedure for the design and fabrication of large Cryogenic Liquid Storage Tanks is covered in detail in the following references:

- 1. APCI Standard Specification for a Field Fabricated Cryogenic Liquid Storage Tank (Flat Bottom), APCI No. 99820A, September 15, 1971 (Doc. #99000341).
- 2. APCI Job Specification 310,000 Gallon Capacity LOX/LIN Storage Tank, APCI No. 71-2775-16.10-1A, September 16, 1971 (Doc. #99000342).
- 3. American Petroleum Institute, Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks, API Standard 620, Fourth Edition, February 1970 (Doc. #99000343).
- 4. International Conference of Building Officials, Uniform Building Code, 1970 Edition, Volume I (Doc. #99000344).



II. Operational Hazards

F. Oxygen Transfer

1. Systems

The following documents describe some of the APL oxygen transfer methods, several typical installations, and the Operations Department overhaul procedures for liquid pumps:

- (1) APL, Centrifugal Oxygen Compressor Manual, Hattingen Plant, APL (Doc. #99000410).
- (2) APL, LOX installation at Customer Sites, APL, I.G.D. Engineering Manual, No. EM 40-01, Rev. 0, July 19, 1971 (Doc. #99000411).
- (3) APL, Procedure for Filling Cryogenic Tanker by Pump at Carrington, APL, I.G.D. Engineering Manual, No. EM 50-01, Rev. 0, May 27, 1971 (Doc. #99000412).
- (4) APL, Procedure for Filling Cryogenic Tankers by Pump at Bracknell, APL, I.G.D. Engineering Manual, No. EM 50-02, Rev. 0, May 27, 1971, (Doc. #99000413).
- (5) APL, Procedure for Filling Cryogenic Tankers by Pump at Stoke-On-Trent, APL, I.G.D. Engineering Manual, No. EM 50-03, Rev. 0, May 5, 1971 (Doc. #99000414).
- (6) APL, Purge Procedure for Cryogenic Liquid Container, APL, I.G.D. Engineering Manual, No. EM 52-02, Rev. 0, June 3, 1971, (Doc. #99000415).
- (7) APL, Procedure for Cylinder Filling and Quality Control (Standard Purity Gases), APL, I.G.D. Engineering Manual, No. EM 55-01, Rev. 0, July 2, 1971 (Doc. #99000416).
- (8) APL, Procedure for the Installation of a Cryogenic Tank, APL, I.G.D. Engineering Manual, No. EM 60-01, Rev. 0, May 19, 1971, (Doc. #99000417).
- (9) APL, Operations Department, Overhaul Procedure, New Malden, APL C 155/9.5 (Doc. #99000418).

II. Operational Hazards

- F. Oxygen Transfer
 - 2. Pipeline Transportation

 $\mathbf{0}_2$ pipelines are presently designed in accordance with the following:

- ANSI B31.8, Gas Transmission and Distribution Piping System, American National Standard Institute (Ex USA Standard), 1968 (Doc. #99000350).
- b. Title 49. Transportation, Part 192 Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards -- Establishment of Minimum Standards, Federal Register, 35, No. 161, August 19, 1970 (Doc. #99000351).
- c. Title 49. Transportation, Part 192 Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards -- Establishment of Minimum Standards, Filing of Inspection and Maintenance Plans, Federal Register, 35, No. 205, October 21, 1970 (Doc. #99000352).
- d. Title 49. Transportation Part 192 -- Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards -- Establishment of Minimum Standards, Odorization of Gas, Federal Register, 35, No. 220, November 11, 1970 (Doc. #99000353).
- e. Title 49. Transportation, Part 192 Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards -- Establishment of Minimum Standards, Miscellaneous Amendments, Federal Register, 35, No. 223, November 17, 1970 (Doc. 99000354).
- f. Title 49. Transportation Part 192 Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards -- Establishment of Minimum Standards, Corrosion Pitting; Notice of Public Hearing, Federal Register, 36, No. 126, June 30, 1971 (Doc. #99000355).



- g. Title 49. Transportation Part 192 Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards -- Establishment of Minimum Standards, Requirements for Central Corrosion, Federal Register, 36, No. 126, June 30, 1971 (Doc. #99000356).
- h. Title 49. Transportation Part 192 Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards -- Establishment of Minimum Standards, Extension of Time for Confirmation or Revision of Maximum Allowable Operating Pressure, Federal Register, 36, No. 176, September 10, 1971 (Doc. #99000357).
- i. Public Law 90-481
- j. Compressed Gas Association, Assembly of Industrial Practices Used for Gaseous Oxygen Transmission and Distribution, CGA Docket 70-11, Third Draft, March 22, 1972 (Doc. #99000345).

Liquid oxygen transfer systems are designed in accordance with:

ANSI B31.3, Petroleum Refinery Piping, American National Standard Institute (Ex American Standard Association), 1966 (Doc. #99000347).



II. Operational Hazards

F. Oxygen Transfer

2. Pipeline Transportation

APL Oxygen pipeline design concepts and criteria are described in the following documents:

- (1) APL, Oxygen Pipelines, APL Engineering Standard LS.30/1, Rev. 0, July 1, 1970, (Doc. #99000404).
- (2) APL, Design and Safety Standards for Carbon Steel Gaseous Oxygen Transmission Lines, APL Engineering Standard LS 30/2, Rev 1, December 1, 1970, (Doc. #99000405).
- (3) APL, Piping Selection Sheet-Carbon Steel-Warm Oxygen Service 150 PSIG (CSO 1.5), APL Engineering Standard LS.31/1, Rev. 0, June 12, 1970, (Doc. #99000406).
- (4) APL, Piping Selection Sheet-Carbon Steel-Warm Oxygen Service 275 PSIG (CSO 2.7), APL Engineering Standard LS.31/2, Rev. 0, January 29, 1970, (Doc. #99000407).
- (5) APL, Piping Selection Sheet-Carbon Steel-Warm Oxygen Service 500 PSIG (CSO 5.0), APL Engineering Standard LS.31/3, Rev. 0, June 12, 1970, (Doc. #99000408).
- (6) APL, Piping Selection Sheet-Carbon Steel-Warm Oxygen Service 720 PSIG (CSO 7.2), APL Engineering Standard LS.31/4, Rev. 0, June 12, 1970, (Doc. #99000409).



II. Operational Hazards

- F. Oxygen Transfer
 - 2. Road, Railroad, Barge, and Pipeline Transportation
 - a. Pressure Relief

The majority of relief devices on LOX tankers and LOX railcars at Air Products have a set pressure of 25 psig and a road safety relief valve set for 15 psig. Several tankers also have safety relief valves with a set pressure of 40 psig and several pumpers have a set pressure of 80 psig. Rupture discs are also provided on the above cryogenic transport equipment which are rated for approximately 1-1/2 times the safety relief valve setting. The relief devices for tankers are designed in accordance with the criteria listed in CGA Pamphlet Number 341 "Tentative Standard Insulated Tank Truck Specification CGA-341 For Cold Liquefied Gases" 2nd Edition, 1970, (Doc. #99000195).

Gaseous oxygen tube trailers containing D.O.T. tubes are provided with frangible discs in accordance with CGA Pamphlet Number S-1.1 "Safety Relief Device Standards, Part 1 - Cylinders For Compressed Gases" 5th Edition, 1969, (Doc. #99000196).

II. Operational Hazards

- F. Oxygen Transfer
 - 2. Road, Railroad, Barge, and Pipeline Transportation
 - b. Contamination Control

Contamination control is insured by Air Products' Quality Assurance Program which monitors on a monthly to four month basis, the product produced at the production facilities and in storage at the cylinder filling facilities. This program is described in detail in the following documents:

- (1) APCI Quality Control Program, District Operations Manual, Section 6.3, July 1965 (Doc. #99000223).
- (2) Scott, D. J., "Analyses Required on Quality Control Samples", May 10, 1968 (Doc. #99000224).
- (3) Ent, W. L., "Revisions to IGD Quality Assurance Cost Procedures", including "Schedule for Submitting Routine Product Samples", October 17, 1966 (Doc. #99000225).
- (4) APCI Analysis Requirements Summary, District Operations Manual, Vol. <u>I</u>, Section 6.3.2, March 1970 (Doc. #99000226).

Assistance is rendered to customers to insure that the customer system is suitably cleaned for oxygen service prior to introduction of oxygen into a new system.



II. Operational Hazards

- F. Oxygen Transfer
 - 2. Road, Railroad, Barge and Pipeline Transportation
 - c. Oxygen Dispersal From Vents and Lines

Liquid oxygen tankers were initially designed with vents extending down to the rear or forward of the control cabinet. It was believed a number of years ago that this was the safest means of disposing of venting oxygen. Within the past several years, design of new tankers have safety relief device vents directed up and back to vent oxygen at an approximate elevation of eight feet above grade. This has substantially reduced the concentration of oxygen enriched atmospheres close to the ground and provided better dispersal of the vapor into the atmosphere.

Gaseous oxygen tube trailers are provided with vent stacks which discharge oxygen straight up into the air above the heigth of the highest tubes on the tube trailer. Weather protection caps are installed on the vent stacks.



II. Operational Hazards

- F. Oxygen Transfer
 - 2. Road, Railroad, Barge and Pipeline Transportation
 - d. Vehicle Accident Procedures

Accident procedures are included in APCI, Fire Extinguishment, APCI Safety Standards 635.30, pages 1, 2, and 4, February 1968 (Doc. #99000197).



II. Operational Hazards

- F. Oyxgen Transfer
 - 2. Road, Railroad, Barge and Pipeline Transportation
 - e. Vibration and Controlled Sloshing

Vibration of tankers in over the road use is minimized by certain inherent factors in tanker design and by careful selection of the running gear. The inner tank vibration is dampened by perlite insulation and by the inner tank supporting system utilizing phenolic materials as thermal barriers. Piping is guided to permit contraction and eliminate unwanted movement resulting from road vibration. Careful selection of commercially available running gear to obtain minimum vibration transmitted to the chassis.

A number of years ago liquid oxygen tankers were provided with approximately three transverse baffles and one additional longitudinal baffle. In striving to achieve lightweight designs and as the longitudinal baffle did not appear to contribute significantly to tanker operation, it has been deleted from recent designs with no detectable adverse effect. The more recent designs include baffles that are a perforated conical design with a hole in the center with an approximate 50 percent open area. A design to minimize the effect of sloshing and obtain maximum tanker capacity with lightweight design is difficult.



II. Operational Hazards

- F. Oxygen Transfer
 - 3. Malfunctions and Failures
 - Plant. Questionable history and the gauge used because it had not been labeled for oxygen service. Man received bruise on left hand. Refer to memo, Schmoyer, W. W., "Specialty Gas Gauge Failure," April 13, 1964 (Doc. #99000257).
 - b. Hose rupture and fire on test gauge equipment at our Shakopee, Minnesota cylinder fill facility on June 9, 1968. Rubber hose should not be used in oxygen service. Man received second degree burns to his face and arms. He was wearing safety glasses. Refer to memo, Hubbs, M. H., "Test Gauge Equipment Failure, Shakopee, "June 12, 1968 (Doc. #99000284).
 - c. APCI, Memo by B. J. Berrettini, "LOX Pump Fires and Explosions," dated June 26, 1970 (Doc. #99000258), Summarizes causes and similarities of seven different APCI/APL transfer pump energy releases.



II. Operational Hazards

F. Oxygen Transfer

3. Malfunctions and Failures

The following information identifies several APCI incidents involving oxygen transfer equipment or instrumentation. APCI reports and documents covering these incidents more fully are also identified by date and Document #.

Date	Doc. #	Author	Equipment	Description
6/28/61	99000274	E. Kehat	Gauges	Tests on orifices to be in- stalled in oxygen service gauges to prevent personnel injury in the event of an energy release or over-pressure rupture of gauge bourdon tube.
8/2/61	99000275	F. K. Kitson	Gauges	Report of requirements for purchasing new gauges and modifications of old gauges to protect personnel in the event of a rupture.
1/64	99000049	W. W. Schmoyer	Vacuum System	Safety Standard 607.2.2.5 on cylinder evacuation system to prevent contamination of fill manifold and cylinders.
7/65	99000270	W. W. Schmoyer	Regulator	Report on operation, use, hazards and general accident causes of regulators.
12/15/67	99000277 99000278	W. L. Ball M. H. Hubbs	Loading	Two reports on an incident whereby a loader's eye was probably saved by glasses when a hammer chip shattered his glasses when tightening a liquid connection.
6/4/68	99000281	M. Hubbs	Cylinder Fill	Cylinder safety blew on fill manifold. Force broke pig-tail and fill manifold, breaking adjacent cylinder loose.



Date	Doc. #	Author	Equipment	Description
12/30/68	99000265	H. H. Master	Pumps	Competitor pump fire had indicated foreign material may have been cause. Reviews our position and specifies suction
				screens be installed where still necessary.
1/24/69	99000266	H. H. Master	Pumps	Same as above but directing and instructing managers to accomplish screen installations.
2/27/70	99000273	H. H. Master	Meter	Near miss report where uncom- patible material was used in
				a ring balance meter in oxygen service and action taken to check and eliminate existing and future problems.
1/19/71	99000276	F. K. Kitson	Vacuum System	Vacuum system arrangement to prevent water from getting
			5 5 5 5 11	into cylinders where Nash water- seal compressor is utilized.
1/26/71 2/19/71	99000267 99000268	R. D. Stompler	Pumps	Review reasons and status of modifications to Operations Department pump to prevent
				recurrence of a similar pump failure at Puerto Rico. Modi-
				fications to lube system addi- tion of suction screens and protective barriers.
2/8/71	99000279	H. H. Master	Loading	Driver pulled away from load area with hose still connected. Stopped in time to prevent
				line or hose breakage.



II. Operational Hazards

F. Oxygen Transfer

3. Malfunctions and Failures

The following information identifies several incidents which occurred with other oxygen equipment together with reports and documents covering these incidents in greater detail.

Date	Doc. #	Author	Equipment	Description
6/26/61 7/7/61	99000259 99000260	S. H. Duffala W. L. Ball	Compressor	Two reports on the 6/21/61 Linde oxygen compressor fire at Great Lakes Steel. Three men were killed. Since all three on site were killed, there is some question on the cause, but it is known they were having trouble with the compressor.
8/62	99000280	M.C.A.	Pump Filter	Report of a missile pad incident where contaminants in a pump filter were probably initiated by a foreign particle at high velocity. The resulting release caused a massive LOX spill.
10/21/63	99000261 99000261A	W. L. Ball J. J. Rendos	Pump	Reflux pump on the Airco plant at Butler, Pa. exploded and killed one man. Piping and pump believed to have con- taminants.
1965	99000262	S. W. Cowles	Pumps	1965 AIChE meeting paper on four separate fires experienced at Armour Agricultural Chemical Company.
1966	99000263	J. J. Rendos	Pumps	Report on cause of two pumps fires experienced by Airco on 5/21/66 and 5/23/66.



<u>Date</u>	Doc. #	Author	Equipment	Description
12/29/67	99000264	H. H. Master	Pipeline	Details were limited on an oxygen pipeline filter fire at a steel mill in India where six people were killed.
6/70	99000269	H. Bauer W. Wegner K. F. Windgassen	Pumps	Article from Cryogenics on tests made for causes of pump fires. Includes mech-
		Hermony of the Bulk State of Her Other State (Felder on the Hermony) Garage (Hermony) of the State of the Sta		anical problems, relation of various metals to com- bustion possibilities and
				intensity, and drop hammer tests on chips of metals and assembly materials.
				그는 그는 이 사람들은 이 그래요?



II. Operational Hazards

F. Oxygen Transfer

3. Equipment Malfunctions and Failures

The two main categories of machinery used for oxygen transfer are compressors and pumps. Malfunctions and failures with these devices have led to numerous design features and operating techniques to prevent failures or at least to prevent serious damage and personnel injury. Most failures have been diagnosed sufficiently to enable action to be taken to prevent recurrence, however, some failures have been unexplained and the resulting action has been protective rather than preventive. Some potential failures are impossible to prevent and these cases are necessarily handled by protective measures.

Materials of construction for compressors and pumps often are not completely compatible with oxygen and under certain conditions will burn. In most instances there is no substitute material which is both compatible with oxygen and which will satisfy the design requirements. In some instances the cost of more compatible materials is prohibitive. Silver is used in limited quantities for shaft seals with some makes of compressors but the high cost has caused some manufacturers to use cheaper less compatible materials. Compressors cast of bronze would be more compatible with oxygen than when cast of iron but the costs and manufacturing difficulties prevent this selection.

Oxygen Compressors Most compressors used by industry for oxygen have been either reciprocating or centrifugal. Generally reciprocating compressors are used for small to moderate flow rates where low to moderate pressures are required. For high flow rates and high pressure a centrifugal and reciprocating compressor are often used in series. Centrifugal compressors require at least 500 CFM actual flow at the last stage of compression for reasonable performance and are generally limited to about 500 psig discharge pressure. Applications with less flow or with higher pressures are usually accommodated with reciprocating compressors.

Potential equipment malfunctions and failures are designed out of the compressor as much as possible during the procurement and design stage. Not all compressor manufacturers are knowledgeable on oxygen compressors and thus the selection of potential suppliers is the first step. Proper purchasing specifications are necessary



to fully describe the duty and design features required. Oxygen compressor suppliers have certain standard features of construction but rely on customer specifications to complete the design. Customer specifications aside from process duty requirements are basically experience factors to be applied to the compressor design. The compressor supplier does not usually receive full feed back information on the operation of the compressor as does the operator. Thus the compressor operator reflects experience factors in specifications for new equipment.

Reciprocating Compressors Reciprocating compressors have been used for many years in oxygen service but until recent years mostly small high pressure units. Prior to the advent of Teflon, and similar materials, for piston rings and piston rod packing most compressors were operated with a soap-water solution for lubrication or used carbon-graphite sealing materials and wear parts. Also in use has been the labyrinth type piston compressor and the diaphragm type compressor.

Present day reciprocating compressors are mostly Teflon ring construction of labyrinth piston construction with a few diaphragm compressors used for low flow high pressure applications.

Some of the notable malfunctions and failures on reciprocating oxygen compressors in recent years which have been "designed-out" are listed below:

Incorrect assembly of compressor cylinder valves such that intake valves were installed in discharge ports. This condition results in recompression in the cylinder and generates excess heat and a high potential for a fire. APCI specifications require a valve design such that an intake valve will not fit into a discharge port.

Foreign objects entering cylinders have caused scoring of cylinders with resultant excess heat and potential fire. Impacting of foreign objects could also cause a fire. APCI specifications require line filters in front of compressors to prevent entrance of foreign objects.

Foreign objects can also be in the form of broken parts from the compressor itself such as valve parts falling into the cylinder. APCI specifications require vibration switches which function on high acceleration or "shock" forces and which shut down the compressor. Experience has shown that the initial impact of the piston with the foreign object causes less damage than the subsequential damage caused by continued operation. Continued operation is likely to cause heat and a resultant fire. For this reason vibration switches must be set to trip the compressor



instantly, upon sensing a malfunction, in order to be effective.

Non-lubricated cylinders using Teflon or similar materials for self-lubricating rubbing or sealing parts are subject to unpredictable wear rates. Since the self-lubricating material generally separates moving metal parts the wearing out of the material can cause metal to metal contact with high friction heat and potential fire. Self-lubricating piston rings are sometimes supplied with an expansion ring to help hold the piston ring against the cylinder bore. In the event of piston ring failure or high wear the expander can come in contact with the cylinder bore. Since the expander is usually spring steel it can cause scoring and heat and a potential fire. APCI specifications prohibit the use of expanders.

Piston rider rings which support the weight of the piston and guide the piston in the cylinder can wear and allow metal to metal contact. Constant monitoring of this wear is difficult and requires disassembly of the compressor. APCI specifications prohibit the use of expanders.

Piston rider rings which support the weight of the piston and guide the piston in the cylinder can wear and allow metal to metal contact. Constant monitoring of this wear is difficult and requires disassembly of the compressor. APCI specifications require a rider band design that will not operate as a seal ring and thus should not wear out before the normal piston rings. Horizontal compressors are specified to have a detector to sense a lowering of the piston rod. The lowering of the rod will indicate wear of the piston rider rings or wear of the crosshead and shows inspection is necessary.

Temperature indication within the compressor system is very useful to detect problems. Interstage gas temperature indicators will detect cooling problems, compressor cylinder valve problems or piston ring leakage. On compressor cylinders with many valves an individual temperature pickup is mounted on each valve to detect a broken or leaking valve.

Centrifugal Compressors Centrifugal compressors are being used more in recent years due to larger volumes of gas to be transferred. High rotating speeds are necessary with centrifugal compressors since the pressure is developed by kinetic energy. Because of the high rotating speeds, accidental rubs between the rotor and case are likely to produce a fire.

The materials used for construction of a centrifugal compressor are generally a compromise between oxygen compatible materials and materials having proper mechanical design properties. The compromise materials must be such that they are compatible with oxygen in the normal mode of operation but may not necessarily

be compatible in the event of a malfunction of internal rub during operation. The prime example of this condition is the common use of stainless steel alloys for rotors and steel or iron alloys for the case. A high velocity rub between the impeller and the case has caused several fires wherein the impeller has been consumed by fire and the case has burned through. Since compatible materials are not available or are prohibitively expensive the compressor is designed to minimize the chances of a rub.

Probably the greatest cause for a fire in a centrifugal compressor is having a rub between an impeller and the case. The compressor design should be such that if a rub does take place the rub should occur at a small diameter section where the rubbing velocity is low. Shaft seals are generally a labyrinth type and do experience rubs since they are designed for small running clearances. These seals are small diameter and of thin cross section with narrow edges such that a rub will generally not cause a fire. The labyrinth blades dissipate the friction heat from the rub adequately to keep the temperature of the materials below their ignition point. Conversely a rub of the impeller at high velocity at a massive section will concentrate the friction heat and ignite the rubbing materials.

APCI specifications require materials of construction and certain running clearances to help design out potential fire causes. Additional preventive measures are taken by instrumenting the compressors to detect malfunctions as they develop and thus take corrective action before a rub takes place. Several of the more important instruments in use are:

1. Temperatures - All interstage gas temperatures before and after intercooling, bearing temperatures and cooling water temperatures. All of these temperatures indicate the condition of the compressor and are of primary importance when used to indicate a change taking place.

High gas temperatures are not necessarily harmful in themselves but the temperature effect on the compressor parts could cause thermal deformations and resulting problems. Of importance is to determine the cause of the temperature rise. APCI connects the compressor discharge temperature indicator to alarm and to shut down the compressor.

Bearing temperatures are an important indicator of bearing performance. Bearings generate considerable heat and a bad bearing will generally increase in temperature. The bearing heat is removed with the circulating lubricant and thus the bearing temperature also gives an indication of lubricant flow.



2. Vibrations - Rotor vibrations relative to the compressor case and rotor axial position relative to the case are constantly monitored and the instruments designed to alarm and to shut down the compressor. The rotor vibrations are very indicative of the mechanical condition of the compressor. The vibrations will indicate rotor ununbalance or looseness, rubs between the rotor and case, bearing problems, and drive coupling problems. Any vibration increase from the normal acceptable level is reason for investigation. APCI standard procedure is to have the vibration instruments sound an alarm at a vibration level 0.5 mils above normal and shut down the compressor at a level 1.5 mils above normal. If a gradual vibration level increase is occurring the compressor will be manually shut down at a level of 1.0 mils above normal.

Axial position of the rotor in the case is maintained by the thrust bearings. A shift of the rotor can allow side contact of the impeller in the case with the previously mentioned fire potential. The position instruments are set to alarm and to shut down the compressor if the rotor moves beyond the limits normally allowed by the thrust bearing.

Vibration monitoring equipment of the proximity probe type, which does not touch the observed shaft, is relatively new and has been very helpful in diagnosing high speed centrifugal compressors. APCI has been able to diagnose many potential problems and perform corrective work prior to a failure with the aid of these vibration sensors. We believe several previous unexplained compressor fires could have been prevented through the use of this type equipment. Because of their importance all APCI centrifugal oxygen compressors are now equipped with radial and axial vibration monitors.

3. Anti-Surge Control - Centrifugal compressors are subject to a condtiion called surge. Surge occurs when the back pressure imposed on the compressor is greater than the compressor is capable of producing and occurs at different pressure values depending upon the flow rate through the compressor. When surge occurs there is a rapid pressure change withing the compressor that usually results in a change in axial force on the rotor and can also reverse the direction of thrust on the bearings. Thrust bearings are usually capable of withstanding repeated surging but it is an aggravated condition and there are many cases of compressor failure caused by surging. Since the surging causes an axial movement a side rub on an impeller is likely and on an oxygen compressor it would probably cause a fire.

All APCI oxygen compressors are equipped to automatically vent or bypass the compressor discharge flow at operating conditions approaching surge. Additional vents will also automatically vent to atmosphere in the event of a shutdown so that the stored volume of gas in the compressor will vent quickly enough to prevent any surge conditions while the compressor is slowing down.

Oxygen Pumps Most pumps used by industry for oxygen have been either reciprocating or centrifugal. Generally reciprocating pumps are used for small to moderate flow rates and for higher pressures. Centrifugal pumps are used for most all flow rates where low to moderate pressures are required.

Oxygen pumps, both reciprocating and centrifugal, are a specialty item and are available from a limited number of suppliers. The special design features, cleanliness requirements and relatively small sales volume makes them unprofitable for most pump suppliers.

Materials of construction are similar for both typs of pumps and fall into the category of acceptable low temperature materials, namely nickel alloys, copper alloys and aluminum. Generally the nickel alloys are used where high strength is required, copper alloys where rubbing contact is expected and aluminum where light weight is required. The copper alloy generally used is bronze and is the most compatible with oxygen of the low temperature metals. Nickel alloys are generally the 300 series stainless steel or Monel.

Oxygen pumps are generally a simple device with few controls or instruments. Most pumps have only a suction and discharge pressure gage to monitor their performance. Oxygen pump usage is mostly for transfer operations where the liquid oxygen is transferred from one storage vessel to another and often from a pressure vessel to a higher pressure vessel or pipe line. This transfer duty is mostly on intermittent operation.

Malfunctions and failures of oxygen pumps are probably due more to the intermittent mode of operation than for any other reason. Starting and stopping of any mechanical device is generally considered detrimental to its long term performance, but with oxygen pumps this condition is greatly exaggerated. Some of the past failures of record and reasons for failure are listed below and it can be seen how intermittent operations affects the pump. Not all failures have been explained and this fact indicates the need for more instrumentation and controls on oxygen pumps. APCI is now working on new standards for oxygen pumps and will attempt to achieve better pumps and better operating techniques.



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<u>Centrifugal Pumps</u> A centrifugal pump is usually trouble free so long as the shaft bearings and shaft seals are intact. Many probelms can develop to cause failures and these will be discussed; but we consider bearings and seals as the greatest problems.

1. Bearings - The pump impeller must rotate at a rapid rate in the pump housing in order to develop pressure. Accidental contact between the rotating impeller and the pump case will cause friction heat and even in a liquid oxygen environment can cause a fire. Most known fires and explosions of centrifugal oxygen pumps were due to impeller rubs and most of these rubs were due to failed bearings. Very few pumps are installed with any instrumentation to monitor the condition of the bearings.

Low speed pumps 3600 RPM and below generally have grease lubricated bearings and are not a general problem when properly maintained. Higher speed pumps are either grease lubricated or oil lubricated and do have bearing problems. Oxygen pumps generally use oxygen compatible fluorinated lubricatns which are inferior to premium petroleum lubricants and do not adequately protect against rust and corrosion within the bearings. Pumps can rust in the bearing area while inoperative and fail prematurely during operation. Fluorinated lubricants are also subject to breaking down and forming acidic products when subjected to excess heat and moisture. These conditions can develop in a pump bearing housing with certain bearing failure as a result. Most pumps use a small amount of lubricant and as a result have very little reserve supply to account for any leakage. Oil lubricated pumps rely on circulation of lubricant with most pumps not equipped to monitor the lubricant flow.

Some pumps have their bearings lubricated with the pumped liquid oxygen and it is critical to maintain liquid in the bearings. The friction heat of the bearings will tend to vaporize the liquid and the bearings can fail under this condition. For this type pump, it is critical to maintain sufficient NPSH to prevent cavitation and thus prevent flashing in the bearings.

Temperature indicators are a good device to monitor the condition of bearings not lubricated with the pumped liquid. Bearings generally increase in temperature as they wear and will rapidly increase in temperature while failing. High temperature switches are a good device to detect bearing failure and to shut down the pump prior to an impeller rub occurring.



- 2. Shaft Seals Oxygen pump shaft seals are generally exposed to the atmosphere which allows oxygen leakage to safely dissipate. Since the shaft seal gets cold while pumping it can condense moisture which will subsequently freeze and form ice deposits. Intermittent operation allows thawing and refreezing which allows water to penetrate the seal and freeze inside the seal surfaces which can cause seal failure. A dry atmosphere in the seal area is beneficial and if heated, affords additional benefit. Dry heated nitrogen is used to blanket the seal area on installations where nitrogen is available. Installations such as on trailers where dry gas is not available can expect more seal probelms.
- 3. Suction Screens Foreign objects entering the pump suction can become lodged between the impeller and case and cause friction heat and fire. All APCI pumps are supplied with suction screens to keep foreign objects from entering the pump.
 - 4. Cleanliness Oxygen pumps, as well as all oxygen handling equipment, must be clear. Too often mechanics are careless and a pump fire or explosion results.
 - 5. Faulty repair Incorrect assembly of a pump can readily allow impeller rubs. Oxygen pump maintenance and overhaul is best performed at central maintenance depots or by the pump manufacturer to assure proper assembly and cleanliness.

Reciprocating Pumps Reciprocating pumps are used almost exclusively where high pressures are required for cylinder filling and high pressure storage systems.

The reciprocating pumps operate at slower speeds than centrifugal pumps and have much slower rubbing contact velocity in the liquid oxygen area. Reciprocating pumps generally operate with a plunger in a barrel with packing or seal rings on the plunger to prevent leakage. In the event of malfunction or excess wear accidental rubs between the plunger and barrel rarely create enough friction heat to cause a fire or expolosion. Material selection for the cold end of the pump is important so as to have materials which can best tolerate rubs without creating excess friction heat and metal to metal galling. Bronze alloys are preferred over stainless steel for this consideration.

Pump packing material in recent years has been predominantly Teflon alloyed with various stabilizers and additives. Prior to Teflon, carbon-graphite mixtures with asbestos were used and are still used to a lesser extent.

January 23, 1972 IIF3-4 (continued)

Cleanliness and proper packing installation are important since the contact area of the packing to the plunger is where the most heat from friction can be expected and where a fire or explosion is most likely to initiate. Operation of a liquid oxygen pump on some other cryogenic fluid such as liquid nitrogen or liquid argon can present a hazard when put back on liquid oxygen service, unless the pump is disassembled and properly cleaned. Minute particles of packing, especially carbon particles, are formed during operation and while on oxygen service are gradually oxidized with no problem. If these particles are formed in a non-oxygen environment and then later exposed to an oxygen environment they will oxidize rapidly and together can result in excess heat with a potential fire or explosion.

Reciprocating pump valves can be a maintenance problem but do not normally present a safety hazard in themselves. Valve failure will cause the pump to stop pumping, however, and continuous operation can develop excess heat within the pump since no liquid flow is present to carry away the friction heat. A discharge pressure switch or flow measuring device set to shut down the pump can monitor against this occurrence.

LOG OF FIRES IN CENTRIFUGAL GASEOUS OXYGEN COMPRESSORS

Mid to Late 1950's - Failure somewhere in South Africa, presumably a Brown Bovari compressor.

1959 - January 15 - McClouth Steel, Detroit, Michigan

Manufacturer	Carrier
Low Pressure Case:	
Model	18 н 3501
Capacity	4,080 cfm
Discharge	94.5
High Pressure Case:	
Model	18 H 3501 I
Capacity	620 cfm
Discharge	399.4 psia
Speed	9500 rpm
Total BHP	1668

The fire occurred in the high pressure casing between the last stage wheel and the balancing piston. The high pressure case burned through and the flames melted and burned through the low pressure cast iron case. The carbon steel shafts apparently were heavily damaged but the cast iron diaphragms showed no evidence of burning. The journal and thrust bearings were not damaged appreciably and apparently did not enter into the combustion reaction.



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1959 - July 10 - Wyandotte Chemical, Geismar, Louisiana

Clark - Type IM8 2 machines in series
Capacity 3150 cfm at 75°F.

BHP 1050
Speed 9500 rpm
Discharge 225 psig

The reaction was confined to the discharge end seal area only. The previous day leakage was found in a diaphragm water nipple, which was repaired during outage of about 30 hours due to process trouble. Fire occurred during startup when oxygen was bled into the machine after 3-hour run-in with nitrogen.

It is speculated that corrosion products caused by water leakage caused frictional heating and ignition in the balance piston area.

1960 - Montecatini, Novaro Chemical Plant

Make Demag Turbo Blower

(purchased in 1952)

Stages Three

Inlet Pressure 1 atmosphere
Discharge Pressure 2.5 atmospheres
Speed 10,500 rpm

Speed of Motor 3,000 rpm

A fire reportedly occurred "some time ago" at the referenced facility. The only data available concerns the design of the machine.

1964 - July 17 - Wyandotte Chemical Company, Geismar, Louisiana

Reaction occurred in same machines involved in failure of 1959.

The fire in the oxygen compressor was associated with explosions and fires in other sections of the process system. It is believed that ethylene oxide backflowed through a connection into the process air stream to the air separation plant, went through the air separation plant and into the oxygen compressors. The low pressure case received only minor damage, but the high pressure case was blown apart. The suction bottle of the low pressure machine was split open and the top heat blown about 250 feet away.



1965 - September 26 - Mingo Oxygen Company, Mingo Junction, Ohio

Fire occurred in piping associated with the compressor but did not involve the compressors themselves.

1967 - December - Poland

A Demag unit reportedly failed shortly after startup. Cause believed to be improper/inadequate cleaning after long period of storage.

1968 - Knapsack Gresheim (Division of Messer), Duisburg, West Germany

At this facility five Brown Bovari centrifugal oxygen compressors discharge into a common oxygen main. On a normal shutdown of one of these machines, which had been in operation for seven years, the discharge check valve failed to operate. The operators also had failed to close the manual discharge block valve, which normally is done prior to shutting down the compressor. After coming to rest, the backflow of oxygen caused the machine to rotate backwards. As the lube oil pump does not operate with reverse rotation of the shaft, the main bearings and thrust bearings received no oil and began to overheat, damaging the bearings and the silver labyrinth packings of the sealing glands and impellers. Excessive heating in the bearings vaporized the remaining oil, finally resulting in an air-oil vapor explosion and fire.

Upon closing the discharge block valve, rotation of the machine ceased and the air-oil fire was put out by the operators. Damage was confined to the bearings and labyrinths. Oxygen was not involved in this reaction, which is of a type that under similar circumstances could occur on a compressor regardless of the material being compressed (whether oxidant, fuel or inert).

1968 - June 17 - Shell Chemical Company, Geismar, Louisiana

Manufacturer

Elliott - 24 HB

Discharge Pressure

265 psia

Capacity

1365 acfm (500 T/D)

BHP

945

Speed

19,403 rpm

Bearing Lubrication

Water

This unit was the high pressure case of a two-case train. The unit had been in steady operation for a period of more than four weeks. There was no indication from the operating records of a change of conditions (loss of power, surging, vibration, pressure or temperature change).

Inspection of the casing revealed the most extensive damage in the area of the first stage impeller discharge. The casing



had been burned through in four places in the plane of the first stage discharge, and the interstage diaphragm was almost completely consumed. Although the second stage impeller was severely damaged, there was very little evidence of combustion in the second stage. The shaft was not burned nor were the journal bearings or thrust bearings.

1968 - June 27 - Air Products and Chemicals, Inc., Sparrows Point, Maryland

Clark IM3 (High Pressure Case). The inboard journal of the high pressure case is believed to have failed during roll—down of the compressor, metal—to—metal rubbing in the inter—locking labyrinth at the balance drum of the high pressure rotor ensuing and causing ignition. The fire broke through at both ends of the high pressure casing and several places in the balance piping. The rotor and high pressure case were damaged beyond repair.

1968 - September - Mekog, Holland

Fire reported in GHH oxygen compressor.

1968 - October - Shell Chemical Company, Geismar, Louisiana

The new Elliott compressor, replacing the unit that burned in June 1968, caught fire and was destroyed the first time an attempt was made to put it onstream.

1968 - December 14 - Air Products and Chemicals, Inc., Weirton, West Virginia

In Clark IM7-3 evidence was found, during regularly scheduled maintenance work, of limited fire damage which possibly occurred during an earlier startup.

1968 - December 27 - Airco, Bethlehem, Pennsylvania

A Demag high pressure casing had fire in discharge volute of last stage.

1969 - Nippon Sanso, Japan

A Demag unit reportedly failed early 1969 or late 1968 in a manner similar to the second Airco Bethlehem fire.

1969 - March 18 - Air Products and Chemicals, In., Middletown, Ohio

A Clark low pressure case, fire beginning in 4th stage, burning through into 2nd stage. Fire occurred during a scheduled shutdown of the compressor.

1969 - April 4 - U. S. Steel, Chicago, Illinois

A Clark oxygen compressor in a Linde plant.

1969 - April 15 - Airco, Bethlehem, Pennsylvania

Fire in same Demag machine that had a fire in December 1968.

1969 - June - August Thyssen Hutte, Duisburg

A GHH centrifugal compressor system. Fire reportedly occurred in the last intercooler causing damage to the intercooler and steel foundations. No damage to the compressor.

1969 - December 5 - Air Products and Chemicals, Inc., El Segundo, California

A Clark high pressure case, Type 161 B 4/4, operating at about 1275 psig, caught fire while being run-in on initial startup.

196<u>?</u> - India

A Clark oxygen compressor reportedly was involved in a serious internal fire at a plant that was being erected by Constructor John Brown (England).

196? - Linde Division of Union Carbide, East Chicago, Indiana

An incident occurred with a Clark 3M4-2MF, 400,000 scfh to 195 psig oxygen compressor.

Machine went down on a general power failure that also shut down driox pumps and the pipe line. Because of cold weather, the fluid in the dash pot on the discharge check valve froze or became so viscous that the valve failed to close. After an elapsed time of about 20 minutes, power to driox pumps was reestablished, the pumps started up, and pressure in the product line was reestablished. Power to the compressor motor and lube oil pumps was not yet on. As the check valve was not closed, oxygen back flowed into the compressor, rotating the rotors backward and without oil to the bearings.

An operator near the compressor noticed the startup of the unit and went to close the manual valve. As this valve was difficult to operate, the man had to close the next valve downstream.

A puff of smoke came out of the lube oil console and one oil drain burned - otherwise the fire was contained inside the case. All seals were out because of friction and fire.



196? - Linde Division of Union Carbide, Gary, Indiana

The Clark oxygen compressor was steam-turbine driven and it was felt that in at least one startup the operators were slow bringing the machine through a critical speed. There was no outward manifestation of difficulty, but when it became necessary to open the case for maintenance reasons, they discovered excessive wear on an interstage labyrinth seal and evidence of contact between the seal and the shaft sleeve, and burning on the shaft sleeve which was stainless instead of monel.

1970 - April - Galatz, Rumania

A fire reportedly occurred during the first week of April on a Demag oxygen compressor. Machines have been running two years. Strainer was installed on these machines made of 18/6 stainless steel in suction line and strainer completely disintegrated, went through machine with resulting fire and destruction of two casings in a three-casing train. The strainers were apparently installed against Demag's advice. No injuries.

1970 - April - Auguste Thyssen Chemical Works near Oberhausen, West Germany

A fire reportedly occurred in a GHH compressor during the first week of April.

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- 2. APCI General Specification for Centrifugal Compressors, APCI No. 550-SD-16A, Revision B8551, April 15, 1965, (Doc. #99000336).
 - 3. APCI General Sepcification for Reciprocating Compressors, APCI No. 550-SD-1A, Revision E7361, March 9, 1964 (Doc. #99000337).
 - 4. APCI Construction Specifications. General Construction and Equipment Erection in Oxygen Compression Systems, El Segundo, California, APCI Section 200 to 200.20 incl., Revision November 17, 1969 (Doc. #99000338).
 - 5. APCI, Machinery Field Testing and Reciprocating Oxygen Compressors, APCI Design Engineering Standard 551.1.9.1, February 3, 1971 (Doc. #99000026).



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- 7. APCI, Piping -- Oxygen Compressor Location, APCI Design Engineering Standard 570.6, January 15, 1971 (Doc. #99000029).
- 8. APCI, Plant Components Air Separation, Oxygen Compressor, APCI Safety Standard 607.1.2.3, December 1962 (Doc. #99000044).
- 9. Lapin, A., "Testing of Screens to be Used in Oxygen Compressor Suction," APCI Memo dated July 26, 1971 (Doc. #99000291).



II. Operational Hazards

- F. Oxygen Transfer
 - 3. Equipment Malfunctions and Failures
 - a. Equipment
 - (1) Gas Pressure Regulators
- 1. The following applies to pressure regulators manufactured by APCI and used by its customers.
 - a. General gaseous oxygen high pressure cylinder and low pressure line station service.
 - (1) Company Practices
 - (a) To provide detailed operating instructions to users including the recommendation that the instructions issued by makers of equipment used in combination with APCI regulators be consulted before operating the units in combination.
 - (b) To provide qualified factory and distributor repair service.
 - (c) To provide precleaned spare parts kits in sealed, dust-tight containers.
 - (d) To package regulators prior to shipment in tight closing protective containers and seal body openings to prevent foreign material from entering the interior of the regulators.
 - (e) To functionally test every regulator for safety and performance prior to final packaging.
 - (f) To provide regulator assemblers with proper tools and supervision to prevent defects being introduced at this point.
 - (g) To promote cleanliness throughout the regulator assembly operation, including an initial degreasing step of parts wetted by the gas.
 - (h) To provide up-to-date design documentation to assemblers to insure the use of proper parts and supplies.



IIF3a-1 (Continued)

- (j) To maintain a high level of quality control of regulator parts through 100% inspection of all significant dimensions and properties prior to their entry into assembly stock.
- (k) To thoroughly degrease and deburr all machined parts prior to inspection and stocking.
- (1) To provide maximum cleanliness and physical control in the assembly stockroom.
- (m) To clearly identify all parts and materials in the stock-room.
- (n) To maintain an ongoing program of product evaluation for safety and performance.
- (o) To thoroughly investigate all reported malfunctions and failures and to take any corrective action indicated to prevent reoccurrences.
- (p) To thoroughly test all new products under controlled conditions simulating those of actual use.
- (q) To corroborate design safety of new products through tests by independent agencies such as Underwriters' Laboratories, Inc. Along with initial testing, UL provides a valuable ongoing inplant quality audit service.
- (r) To provide and maintain accurate, clear, and up-todate engineering drawings and specifications and a system for effectively communicating changes to those who will execute them.
- (s) To use all available technical information in the selection of the materials of construction and the specific design features of regulators and to keep abreast of new technology which can be applied to improving the inherent safety of regulators.
- b. Gaseous oxygen high pressure cylinder and low pressure line station service with oxy-fuel welding, cutting and heating equipment.
 - (1) Company Practices
 - (a) All of a (1)
 - (b) To provide specific instructions pertaining to this service warning of the special precautions necessary to insure safety of operation

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IIF3a-1 (Continued)

c. Discussion:

It is the intent of these practices to prevent equipment malfunction and failures due to:

- (1) Improper design
- (2) Faulty manufacturing practices
- (3) Inadequate cleanliness
- (4) Improper use
- (5) Improper maintenance and repair

Adherence to these practices is the responsibility of the Gas Equipment Department of APCI. Their efforts are audited by the APCI Corporate Safety Department.

d. Related APCI documents

- (1) APCI, Product Test Procedures 1200 Series Regulators, APCI January 30, 1970 (Doc. #99000287).
- (2) APCI, Operating and Safety Instructions for Regulators and Compressed Gases, APCI, Welding Products Division, WPD4-70 (Doc. #99000288).
- (3) APCI, Set Up and Operating Instructions for Air Products Redi-Set^R Welding and Cutting Outfits, APCI Form 3424 WPD 003-M-406000 (5M 92569) Rev 3 (Doc. #99000289).
- (4) Kokinda, J. J., 1200 Series Regulator -- Materials of Construction #231-G-120054 (oxygen), Drawing #000-0-4070004E, APCI, October 25, 1971 (Doc. #99000290).
- (5) APCI, Master Drawing 1200 Series Regulations, APCI Drawing 000-0-407004E, March 4, 1968 (Doc. #99000308).
- (6) Compressed Gas Association, Safe Handling of Compressed Gases, CGA Pamphlet P-1, 1965 (Doc. #99000271).
- (7) American Welding Society, Safety in Welding and Cutting, USAS Z49.1, 1967 (Doc. #99000272).



II. Operational Hazards

- F. Oxygen Transfer
 - 3. Malfunctions and failures
 - a. Equipment
 - (3) Valves
 - x. Avoidance of galling Bronze or monel globe valves with bronze or monel trim should be used for throttling or bypassing oxygen control valves regulators. When the size of the valve is such that a stainless steel body is the only practical valve available commercially the trim should be bronze or monel. If a Colmonoy 6 hard faced stainless steel seat and disc are used, the disc locknut must be bronze or monel to avoid any galling between a stainless steel stem and disc. Galling occurs readity with stainless steel in dry gas systems.
 - y. Check valves in 02 service should be monel or bronze.
 Wafer swing type with Kel-F disc inserts do an adequate job when used with centrifugal compressors.
 For reciprocating compressors, a swing check design is inadequate and would break down in a very short time. A reciprocating compressor plate type check valve or valve specifically designed for reciprocating service must be used.



II. Operational Hazards

- F. Oxygen Transfer
 - 3. Malfunctions and Failures
 - b. Geisering, Excessive Vibrations, Shock (Thermal and Pressure), Line Surges.

The Bibliography (p. 86) of the APCI Report, An Analysis of Water Hammer in Cryogenic Transfer Lines, The Mississippi Test Facility of the George C. Marshall Space Flight Center, National Aeronautics and Space Administration; APCI, February 28, 1964 (Doc. #99000358), lists several publications and articles covering the subject matter.



II. Operational Hazards

F. Oxygen Transfer

3. Malfunction and failures

c. Insulation system deterioration due to vibrations

Oxygen piping is insulated with cellular glass and urethane insulation. Cellular glass insulation is used to insulate all flanges, valves, pumps, etc. where oxygen process leakage may occur in normal operations. This insulation is used for a minimum horizontal distance of 4 feet and minimum vertical distance of 10 feet on either side of the preceding locations. Urethane insulation is used on the remainder of the piping.

Cellular glass insulation is a friable material and subject to failure by vibration. The interior or bore of the inner layer of insulation is coated with a vinyl base compound to reduce abrasion from vibration and temperature change of piping.

Excessive piping vibrations, however, would be detrimental not only to the insulation system but to other mechanical devices and should be eliminated.

Urethane insulation is not friable and no special vibration cushion is used.



II. Operational Hazards

- G. Fires and Explosions
 - 1. Methods to contain or restrict combustible mixtures.

The application of a safety factor in the design of oxygen process, storage, and handling systems for the temperature and pressure of service, provides a measure of containment for only minor reactions which occur from ignition of combustible mixtures. Containment of catastrophic high energy reactions is not considered in design for practical and economic reasons.

The intent of process design is to restrict, where possible, the entrance of combustible mixtures in oxygen process, storage, and handling systems. The methods through which this can be accomplished are (a) mechanical devices, (b) instrumentation, and (c) operating procedure.

- a. Mechanical Devices Mechanical devices are additions to oxygen systems which provide a measure of protection to restrict combustible mixtures. They may be part of the process design, requirements of codes, requirements of industry practices, or a completely separate auxilliary component for a specific function. These mechanical devices may be manually or automatically operated.
 - (1) Industry developed standards, although not mandatory, requiring different valve outlet connections on cylinder valves for the different compressed gases contained in cylinders. Corresponding fittings of fill lines and various accessories are in agreement with the cylinder valve outlet connections. The purpose of this standard is to prevent the accidental filling of cylinders with the wrong and possibly hazardous product. Industry practice is published in Pamphlet V-1, Compressed Gas Cylinder Valve Outlet in Inlet Connections by Compressed Gas Association, Inc. (1) and contains the American Standards B57.1-1965(2) and the Canadian Standard B96-1965(3).



- (2) Exhibit "A" of Plant Operations Manual, Section 2.02(4), lists the fixed ends of transfer hoses and storage tank connections to be used for the different cryogenic liquid products to prevent intermixing at filling or customer storage sites.
- (3) Process design of oxygen producing equipment includes the use of filters, scrubbers, and driers to remove contaminants from the process stream, and the use of hydrocarbon and guard absorbers to handle contaminants which manage to slip through with the process stream. Check valves are used to prevent reverse flow of material and double block and bleed valves are used to isolate circuits where hazardous materials are associated by design with oxygen producing, handling, and storing equipment.
- Instrumentation Total hydrocarbon, acetylene spot check, oxygen, nitrogen, and other analyzers are used to continuously or intermittently monitor the various process streams of plants to detect the presence of contaminant materials which might be detrimental to the safety and operation of the equipment. This instrumentation can be tied to alarm and shutdown switches to provide an automatic system for alerting personnel to an impending hazardous situation and for protecting equipment. The area and atmosphere surrounding operation equipment are checked with portable oxygen analyzers at regular intervals or as the operation demands for oxygen enrichment or oxygen deficiency to alert personnel of a potential hazard. An explosimeter is frequently used to check the presence of flammable gases, if the process involved uses these materials.
- c. Operating Procedures Operating procedures have been developed for oxygen process, storage, and handling systems which, in addition to optimum operating efficiency, minimize or eliminate the possibility of combustible mixture formation within equipment. Some important operating procedures to achieve control of combustible mixture formation are listed below:
 - (1) Safety Standard 626.4.1, Purging Methods, ⁽⁵⁾ establishes concentration limits concerning purge operations where oxygen or air may possibly be introduced in flammable gas processes or storage systems. The purge media is nitrogen.



- (2) District Operations Manual, Section 6.3, Quality Control Program, (6) lists the requirements for the regular scheduled check and double check on products at a specified quality, this control program detects the presence of contaminants which may effect the safe operation or the process handling or storage system. Similar procedures have been included in the Plant Operations Manual to maintain quality of product.
- (3) Detailed procedures exist in the District Operations Manual, Section 9.1(7), and the Plant Operations Manual, Section 2.02, (4) for the filling of containers with gaseous and cryogenic liquid products.
- 2. Avoidance of chemical reactions and flashbacks.

A safety review of APCI process, storage, and handling systems is made for the purpose of determining compatibility with gaseous or liquid oxygen. The possibility of chemical reactions with oxygen are examined during the safety review.

The many different applications in which oxygen is used by other than the producer is an area where a safety review is generally not made excepting where specifically requested. This service is available to customers and when requested, considers the chemical reaction possibility.

A universal application of oxygen is in conjunction with acetylene in the welding and burning of metal processes where piped systems are used to distribute the gases to their points of use. Design of these systems is in agreement with National Fire Protection Association Code No. 51, Welding and Cutting, Oxygen-Fuel Gas Systems (8). Hydraulic flash arrestors are used in the fuel system to prevent flame from getting back to the supply source. Check valves are used at the individual use points to prevent the intermixing of gases and the formation of flammable mixtures within the system.

3. Avoidance of shock Sensitive Materials.

Materials used in oxygen process, storage, and handling systems must meet the requirements as listed in Safety Standard 609.1, Compatible Materials (9) and must be suitable for the temperature and pressure of the service as specified by applicable professional and industrial codes.



- 4. Methods to reduce the vulnerability towards internal and external fires.
 - a. Quantity-distance requirements of the National Fire Protection Association Code No. 566, Bulk Oxygen Systems at Consumer Sites(10) and NFPA No. 50(11) are used for both gaseous and liquid oxygen storage on customer property.
 - b. The same rules (NFPA No. 566) apply at producing facilities with possible expansion of distances between oxygen compressors and other equipment.
 - c. In the case of oxygen compressors, inventory dump accessories are provided along with appropriate instrumentation and shut-down devices to vent the oxygen, close the inlet valve, introduce nitrogen into the compressor and piping, and stop the compressor.
 - d. An oxygen compressor is always started on nitrogen and the system completely checked prior to introduction of oxygen to the system.
 - e. Plant liquid, when product quality or other reasons dictate, is drained and disposed in a location away from main plant components through a vaporizer.
 - f. Trailer vents are connected to a vapor disposal system which exhausts the vapors in an area away from plant components or where personnel may be working.
- 5. Protection provided for adjacent components from internal or external fires.
 - a. Personnel protective shields as per Design Engineering Standard 546.1(12A) used around oxygen compressors have a secondary purpose of offering protection to adjacent components.
 - b. The above practice is being extended to cover protective shields around plant mounted centrifugal liquid oxygen pumps.
 - c. The oxygen compressor control panel position must be in agreement with Design Engineering Standard 546.1(12) requirements and must have a protective roof as per Design Engineering Standard 534.1(13).



- d. Operating plant liquid oxygen transfer from storage to rail or highway tanker loading areas are provided with a manually operated water deluge system for fire protection and vaporization of liquid spills.
- e. Fire fighting capabilities are provided at strategic locations throughout producing facilities. Fire hydrants, hose houses, hose reels, and fire extinguishers, as specified in Safety Standards 630.2.2(14), 630.2.3(15), 630.2.6(16), and 630.2.2(17).

References

- (1) Compressed Gas Association, Compressed Gas Cylinders Valve Outlet and Inlet Connections -- CGA Pamphlet V-1, 1965, (Doc. #99000235).
- (2) American Standard, Compressed Gas Cylinder Valve Outlet and Inlet Connections, American Standards Association, B57.1-1965, (Doc. #99000236), published as CGA Pamphlet V-1, 1965 (Doc. #199000235).
- (3) Canadian Standard, Compressed Gas Cylinder Valve Outlet and Inlet Connections, Canadian Standards Association, CSA B96-1965, (Doc. #99000237), published as CGA pamphlet V-1, 1965, (Doc. #199000235).
- (4) APCI, Filling Procedure for Transportable Cryogenic Containers (250 Gallon Capacity or Larger) -- General -- APCI Plant Operations Manual, Section 2.02, August 29, 1969, (Doc. #99000238). (Same as D.O.M. Sect. 9.1).
- (5) APCI, Purging Methods -- APCI Safety Standards 626.4.1, January 1970 (Doc. #99000240).
- (6) APCI, Quality Control Program -- APCI District Operations Manual, Section 6.3, April 1968, (Doc. #99000223).
- (7) APCI, Filling Procedure for Transportable Cryogenic Containers (250 Gallon Capacity or Larger) -- General -- APCI District Operations Manual, Sect. 9.1, April 1966, (Doc. #99000239). (Same as D.O.M. Sect. 2.02).



- (8) National Fire Protection Association, Standard for the Installation and Operation of Oxygen-fuel Gas Systems for Welding and Cutting, NFPA No. 51, 1969, (Doc. #99000242).
- (9) APCI, Oxygen Compatible Materials -- APCI Safety Standards, 609.1, June 1964, (Doc. #99000051).
- (10) National Fire Protection Association, Installation of Bulk Oxygen Systems at Consumer Sites, NFPA No. 566, 1965, (Doc. #99000190).
- (11) National Fire Protection Association, Installation of Bulk Oxygen Systems at Consumer Sites, Proposed Amendments Part II to NFPA No. 566, Passed May 1971, to be designated as NFPA No. 50, (Doc. #99000191).
- (12) APCI, Personnel Protective Shields, Oxygen Systems -- APCI Design Engineering Standards 546.1, January 15, 1971, (Doc. #99000025).
- (12A) APCI, Personnel Protective Shields, Oxygen Systems -- APCI TB-42, Applicable to APCI Design Engineering Standard 546.1, September 30, 1971, (Doc. #99000328).
- (13) APCI, Oxygen Control Panel -- APCI Design Engineering Standard 534.1, (to be published)(Doc. #99000243).
- (14) APCI, Fire Protection Equipment, Outside Fire Hydrant, APCI Safety Standards 630.2.2, July 26, 1961, (Doc. #99000244).
- (15) APCI, Fire Protection Equipment, Outside Hydrant House and Equipment, APCI Safety Standards 630.2.3, June 15, 1960, (Doc. #99000245).
- (16) APCI, Fire Protection Equipment, Deluge Systems LOX Loading Facility, APCI Safety Standards 630.2.6, January 1964, (Doc. #99000055).
- (17) APCI, Fire Protection Equipment, Inside Outside, APCI Safety Standards 630.3.2, May 1968, (Doc. #99000246).



III. Maintenance Program

A. System Check and Inspection Where, Why, and How

1. Structure

Structural inspection is made on a yearly, monthly, or daily task depending on the equipment and location.

Listed below are a few examples as used in the Operations Department.

- a. Inspect general condition of piping system. This should include pipe supports for overloading, deflection and cracked welds. The piping is checked for excessive stress or sagging. This is done on a daily task and is a visual inspection.
- b. Inspect general condition of enclosures of pumps and cold piping. This is generally considered as cold boxes and cold piping duct work. Over pressure protection devices are provided on these systems. The number and kind of devices and set pressure are based on the configuration, pressure rating, purge pressure, and the type insulation used in the box.
- c. Inspect general condition of Lox Storage Tanks. This inspection is depended on the type of tank. The normal structual inspection will include foundations, supports, insulation level, vacuum readings, and general condition.



III. Maintenance Program

A. System Check & Inspection Where, Why, & How

2. Leaks

Major liquid and cold gas leaks are repaired immediately because of possible foundation heaving, over pressuring of jacket, or cracking of carbon steel structural members. First indications of leaks are frost spots and changes in purge pressure or cold vapors. A detailed procedure is attached from the APCI Plant Operations Manual section 1.14, Cold Box Leaks, Nov. 10, 1968 (Doc. #99000227). Should the leak occur in a coded vessel APCI Plant Operations Manual Section 6.09, Coded Vessels Repair, November 29, 1968 (Doc. #99000228) must be used. Quality Control Layout Pneumatic Testing QCL105A, July 1, 1971 (Doc. #99000207), and Quality Control Layout, Hydrostatic Testing, QCL117A, July 1, 1971 (Doc. #99000206) are used for testing after the repairs are made.



III. Maintenance Program

- A. System Check & Inspection Where, Why, & How
 - 3. System Instrumentation and Controls

System instrument and control checks in operations are continuous as readings are taken on hourly basis and a malfunction of most of them will give an alarm and/or shutdown of related equipment. The Plant Operations Manual Section 6.05, Instrumentation Preventive Maintenance, October 30, 1968 (Doc. #99000229) gives inspection procedures and frequencies. The safety relief valves and rupture discs are inspected as per Plant Operations Manual section 6.02, Safety Valves and Rupture Discs, December 8, 1969 (Doc. #99000230).



III. Maintenance Program

A. System Check & Inspection Where, Why, & How

4. Insulation

Insulation check and inspection is accomplished on a daily visual inspection and in more detail when the preventive maintenance manual requires it.

Insulation of interconnecting lines which contain low temperature streams require insulation to prevent heat input to the stream and to provide personnel protection from cold temperatures.

Insulation for liquid oxygen lines or other lines which may come in contact with liquid oxygen are non combustible to protect against the possibility of a reaction in the event of a liquid leak.

Process lines operating at temperatures colder than the condensing temperature of air are insulated with material compatible with oxygen.

Appropriate weather protection that was applied to the insulation must be maintained.

III. Maintenance Program

- A. System Check and Inspection; where, why, and how
 - 5. General Considerations of the "aging" system

Inspection of Bulk Oxygen Storage Systems. IGD inspection procedures for gaseous and liquid oxygen storage systems at consumer sites are contained in District Operations Manual Volume 1, Section 4.2.3, and Section 4.1.3, respectively.

- a. APCI, Maintenance and Inspection Requirements for Customer Bulk Gas Supply System, APCI District Operations Manual, Vol. 1, Section 4.1.3, June 1971 (Doc. #99000192).
- b. APCI, Maintenance and Inspection Requirements for Bulk Liquid Customer Installations, APCI District Operations Manual, Vol. 1, Section 4.2.3, May 1969, (Doc. #99000193).



III. Maintenance Program

- A. System Check & Inspection, Where, Why & How
 - 5. Preventive Maintenance Program

All of operations facilities are on a formal P.M. Program. Manuals are issued listing all tasks with a definitive numbering system for each of the tasks. Work required on a monthly or less frequent basis is on an IBM Card and the cards are distributed each month at which time the task is to be performed. The Operations Dept. Preventive Maintenance Report, Feedback Card (Doc. #99000231) is filled in if and when the work is done and returned to the corporate offices. Each month a report is issued indicating compliance in percent of "Normal" tasks and "Downtime" tasks. Man hours expended in each category are also noted. In the event downtime tasks cannot be done due to operating requirements, they can be rescheduled and they are not penalized in the compliance report. Further details are given in the "Plant Preventive Maintenance Control" Document, June 1971 (Doc. #99000232). Also attached are a few representative pages of the PM Manual.

The following lists are representative of maintenance program entries on oxygen equipment or related items. Frequencies of the maintenance tasks are also noted with one period in some cases and with a range of period intervals in others. It must be understood that the frequency is a function of not only the type of the equipment in this category but also its history, process, usage, vendor and construction which may dictate more or less frequent task requirements.

Oxygen Gas Storage

l.	Inspect valves and packing for leaks	Weekly
2.	Inspect general condition of vessels, supports and piping for paint requirements.	l Year
3.	Check exterior of storage vessels, vessel supports and safety valve equipment. Check shut off valve.	l Year
4.	Soap test storage bank piping at maximum working pressures.	3 Years



Lox Storage and Piping

1.	Check	valve	packings	for	leaks.	Inspect	boots	on	ex-	
	tended	l stem	valves.							

Daily-Weekly

2. Inspect relief valve for leakage.

Daily

3. Inspect interconnecting piping and insulation.

Weekly

4. Inspect storage tank and crossover for frost spots.

Weekly

5. Check crossover for oxygen concentration

Weekly

6. Inspect top of tank and jacket vents.

Weekly

7. Check and top-off insulation level.

l year

8. Check to ensure controller for foundation heating is maintaining its set point. Recalibrate according to manufacturers instructions.

6 mos.

9. Check vacuum reading and record

l year

10. Check purity from top of Lox Storage Tank.

weekly

Lox Pumps

1. Defrost pump. Clean and inspect pump suction screens. Clean or replace as necessary.

3 mos.-l yr.

2. Inspect for pump seal (or packing) leakage. Listen for Shift-Daily any unusual noises or vibration. General visual inspection of pumps and motors. Check nitrogen purge flow. Daily.

3. Check oxygen concentration in box.

Weekly

4. Check pump box for frost spots and general condition.

Weekly-Monthly

5. Inspect condition of blowout panels on box.

Weekly-6 mos.

6. Lox Pump (BJ)-Perform solvent wash. Prior to and after solvent wash inspect internal parts with a black light and report observations.

3 yr.

7. Lox Pump (External, usually transfer pump)-After 500 operating hours overhaul pump replacing bearings as well as other worn parts.

6 mos.

8. Lox Pump (BJ)-Perform thorough check of entire pump assembly. Replace parts as necessary. Change gear case oil. Perform wash out.

12-36 mos.



9.	Lox Pump (BJ)-Rotate shaft by hand one full turn before an after cooldown.	d Start up			
10.	Inspect general condition of pump and piping system for product or oil leaks.	Daily			
Vaporizers					
l.	Check steam regulator valve. Check condensate trap.	3 mos.			
2.	Inspect all steam piping valves and fittings for leaks. Repair as necessary. Inspect steam drain lines and traps for plugging. Clean as necessary.	Daily-weekly			
3.	Inspect vaporizer for cracks and general condition. Repair as necessary	Daily			
4.	Pressure test product oxygen coil	monthly			
5.	Shift test shell vent for high oxygen. Report and readings greater than 21% oxygen.	monthly			
6.	Drain water side. Flush out and refill.	6 mos.			
7.	Wash vaporizer internally. Use methylene chloride.	4 years			
8.	During freezing weather check water bath temperature, heater on at 35°F and off at 40°F. Check panel heater operation.	Daily			
9.	Thermal Research Vaporizer checks.				
	a. test flame guard system.	Daily			
	b. test run burner. Allow system temperatures to reach normal operating levels.	11			
	c. Check flame stability through sight port. Adjust as necessary.	11			
	d. Visually inspect for leaks and sign of overheating	**			
	e. Check combustion air blower and circulating water pump for unusual noise or vibration.	99			
	f. Record one complete set of log readings (reconsider schedule after 3 months)	11			

IIIA5-2



g. Inspect flame scanner lenses for crackes and dirt.

Clean or replace as necessary. Inspect spark plug gap
setting. Inspect blower discharge sleeve. Perform
daily system test after performing the above work. Check
for corrosion and requirements for touch-up
painting.

Monthly-6 mos.

- h. Replace scanner cell. Clean gas filters on combustion and oxygen analyzer. Inspect combustion blower. Clean as necessary.
- i. Clean water circulating pump suction strainer. monthly
- j. Remove and disassemble burner. Inspect for damage to ceramics and combustion chamber. Split burner at flange just below spark plug and thoroughly inspect ceramics for deposits, cracks and spalling or other damage. Replace scanner cell.

24 mos.

k. Check tubes, tube supports, baffles and interior of shell for corrosion. Make inspection with burner removed and by removing bottom manhole and section of stock.

24 mos.

Loading Stations

- 1. Trailer and railroad loading station lot filters. Inspect and service as necessary. 6 mos.
- 2. Inspect all loading connections and hoses for wear or abuse.

 Replace faulty connections or hoses.

 Daily

Cylinder Filling

1. Inspct all copper pigtails for wear and replace as necessary. Monthly

2. Anneal all copper pigtails 6 mos.

3. Inspect tube trailer stanchion hoses, tubing and fittings for leaks, damage and proper anchorage. Repair or replace as necessary.
6 mos.

4. Calibrate all cylinder manifold pressure gauges. 3 mos.

5. Check and calibrate pressure switches. 1 year



General

1. Perform visual inspections of all safety valves. Leakers, no seal, illegible or missing date tags, signs of corrosion, etc. will require retest, repair, or replacement as necessary.
1 year

Further Details are given in the Following:

- a. Plant Preventive Maintenance Control, June 1971 (Doc. #99000232)
- b. Monthly Plant Safety Survey, Form 2032, Sect. 5.18 (Doc. #99000233)
- c. Kitson, F. K., Approved Alloy Steels in Cryogenic Service, Safety Gram No. 10, Rev. 1, October 25, 1963 (Doc. #99000040).



III. Maintenance Program

B. Safe Cleaning Procedures for Filters, Traps, and Instruments

Filters

The only standard locations for any numbers of filters or strainers in oxygen service are the suction lines to pumps, suction lines to compressors, discharge lines of high-pressure reciprocating pumps, and in-line product filters for government requirements.

When we were using pumps in plant processes for pumping through heat exchangers to vaporize against incoming air we had suction filters on the suction lines to prevent larger particles of desiccants, solder and any other foreign material from entering the pump. There are a few of these systems still in operation but concept has changed, and we generally do not utilize this process anymore (liquid vaporization from storage, or oxygen gas compressors have succeeded this method). Generally construction was per our print 58521C(1) which has related prints specifying 10 mesh monel wire cloth, which is backed by 304 stainless steel perforated sheets (cylindrical).

We now have screens in all our transfer pumps suction lines. They have 100 mesh stainless steel conical screens. This action was prompted by fires in pumps in Airco at Bethlehem where it was believed foreign material caused the incidents.

Our old high pressure reciprocating pumps, which have graphite packing, have sintered bronze (porex) filters on the discharge side of the pump to prevent graphite and asbestos particles from getting into the exchangers and subsequently into cylinders or other area where it would be undesirable.

Government specifications for LOX require filtration of our product. Where necessary, we install in-line filters on our product hoses used to load trailers for government locations. We are presently using a Pall Trinty Rigimesh (stainless) 10 micron, 98 percent removal, 40 micron absolute removal filter assembly.

All of the above filters are cleaned in methylene chloride or trichlorethylene and blown dry with nitrogen. Air known to be dry and oil free is also permitted for drying.



Traps

I do not know of any so-called traps used in any of our oxygen systems excepting the suction line of the old APCI high-pressure reciprocating pump. At one time we had used brass refrigeration filters here, but later put a U-type "plumbers" trap made from copper return bends or street elbows just upstream of the pump. It was intended only to hold any heavy material, such as solder, in this low point and prevent the foreigh material from getting into the pump or the pump valves.

This trap was cleaned initially as part of the original piping and had no further cleaning requirements.

Instruments

Instruments are generally cleaned according to our QCL 116F⁽²⁾. Design Engineering Standard 531.2⁽³⁾ specified gauges be cleaned to 116F. It also states a decal "Oxygen - Use No Oil" be affixed to the gauge.

The only other formal cleaning procedure for instruments that I could find in manuals and inquiries in the Engineering Department was QCL 102F⁽⁴⁾, Cleaning Bourdon Tube Type Gages for Oxygen Service.

References

- (1) Oxygen Pump Filter Assembly, APCI Drawing #58521C, Rev. B, December 18, 1957 (Doc. #99000234).
- (2) APCI Requirements for Class AA Cleaning -- APCI Quality Control Layout No. QCL 116F, July 1, 1971 (Doc. #99000085).
- (3) APCI Instrumentation Pressure Indicators -- APCI Design Engineering Standards 531.2, October 1963 (Doc. #99000022).
- (4) APCI Cleaning Requirements for Boudon Tube Type Gages Used For Oxygen Service -- APCI Quality Control Layout No. QCL 102F, July 1, 1971 (Doc. #99000078).

III. Maintenance Program

C. Pressure Testing

The following steps are followed in pressure testing

- 1. Secure a safety work permit
- 2. Areas where testing is taking place is to be considered offlimits for personnel except for authorized people doing the work. Rope off the area and display applicable signs.
- 3. Whenever possible, hydrostatic testing is to be utilized in preference to pneumatic testing.
- 4. Never test a circuit without a proper relieving device, such as a relief valve or rupture disc, as an integral part of the circuit or vessel.
- 5. Always use a regulator when pressurizing circuits with highpressure cylinders.
- 6. Always use dry and oil-free fittings and lines when pressureizing oxygen circuits. Also, the pressurizing medium, nitrogen or air, must be dry and oil free.
- 7. Build up pressure gradually to 50 percent of test pressure and then in increments of 10 percent until test pressure is reached. This is especially important on high-pressure circuits. Hold a proof pressure for at least five minutes and then reduce 10 percent before "moving in" for soaping and visual inspection.
- 8. Stand clear of equipment while it is being pressurized.
- 9. Never stand in line with pipe corps, plugs, or blinds which can blow loose under pressure.
- 10. Before pressurizing circuits, be sure all valves are set properly and know where vent valves are located in the event that quick venting of pressure is necessary.
- 11. The pressure gauge must be visible to the operator when pressurizing a vessel or circuit. In cases where the operator cannot see a gauge, a second person observing the gauge must relay signals to the operator.



- 12. After pressurizing a circuit, wait several minutes before attempting to check lines or soap test. Remember, some flux can hold high pressure temporarily.
- 13. Be careful when venting and relieving pressures. Be sure all personnel are clear. Anchor all lines to prevent "whipping". When possible, vent upward rather than at lower levels.
- 14. If a circuit is left pressurized, warn all personnel at charge of shifts and leave signs reading "Danger Under Pressure" in conspicuous places. Hourly checks are to be made by qualified persons to check the equipment and guard against over-pressure due to temperature.
- 15. Never walk away from an unfinished solder joint, threaded joint, etc. because of a rest break or shift change. Always finish the joint.
- 16. Be sure fittings, valves, and piping for the hookup are suitable for pressures involved.

Other Sources of Information

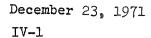
- 1. POM 1.03, Safety Control Procedure TagOut, and POM 1.04, Safety Control Procedure Safety Work Permit has some relationship with pressure testing as they are procedures to prevent inadvertent pressurizing of vessels or circuits not intended to be part of the test. Also, tagging of the valves serve as warnings to those individuals not part of the actual work. See attachments. These POM procedures are the same as Safety Standards 626.3.3 and 625.3.5.
- 2. POM procedure 6.09, Coded Vessel Repairs, outlines Operations Department action on coded vessels including pressure test. QCL 117A, Hydrostatic Testing - General and QCL 105A, Pneumatic Testing - General, are attachments to this POM procedure which are Manufacturing Department procedures used in conjunction with our work.

APCI References:

- 1. APCI Safety Control Procedure Tagout, APCI Plant Operations Manual Section 1.03, February 15, 1967 (Doc. #99000202).
- 2. APCI, Safety Control Procedure Safety Work Permit, APCI Plant Operations Manual Section 1.04, February 16, 1967 (Doc. #99000203).



- 3. APCI, Coded Vessel Repairs, APCI Plant Operations Manual Section 6.09, November 29, 1968 (Doc. #99000204).
- 4. Maryland Casualty Company, APCI Field Inspection Contract with Maryland Casualty Company, APCI Plant Operations Manual Section 6.09, Attachment 1, August 27, 1969 (Doc. #99000205).
- 5. APCI, Hydrostatic Testing General, APCI Qaulity Control Standards QCL 117A, October 20, 1958 (Doc. #99000206).
- 6. APCI, Pneumatic Testing General, APCI Quality Control Layout QCL105A, July 1, 1971(Doc. #99000207).
- 7. Smith, H. W., APCI Safety Control Procedures -- Tag Out Procedures, APCI Safety Standards 626.3.3, May 1962 (Doc. #99000208).
- 8. Smith, H. W., APCI Safety Control Procedures -- Air Separation Plant Safety Work Permits, APCI Safety Standard 626.3.5, June 19, 1961 (Doc. #99000209).





IV. System Emergencies

APCI Safety Standard 626.3.8, Emergency Procedures, May 1962 (Doc. #99000053), is the guideline for establishing specific emergency procedures for each company location considering the function of the facility and the number of people employed. The emergency conditions considered are equipment malfunction or failure, human failure, extreme climatic conditions, or national emergency.



IV. System Emergencies

A. Safety Training and Area Placarding

1. Safety Training

a. Safety Meetings

Safety Standard 625.0.1⁽¹⁾ (duplicated as POM 5.16⁽²⁾) requires at least one safety meeting each month. This is generally complied with and all personnel are covered by the most practical scheduling. Reports on the meetings are submitted to the Operations Safety-Service Manager where they are reviewed and recorded for compliance. Noncompliance is questioned and reported to Operations management as necessary.

Generally, plant management is spokesman at the meetings. Experts from the corporate offices may hold the meetings occasionally on subjects in which they are more proficient. Also, technicians (mechanical or electrical, etc.) assigned to a range of plants may speak on safety problems in their particular fields and theories of same so a better understanding of the equipment and operating principles may prevent accidents.

Topics can be a wide range of general industrial, personnel protective, equipment or process divisions. The facilities' current problems would be given priority. Second priority would be recent problems at other plants which may be directly related to the facilities' operations. Plant managers are kept posted on these problems in order to insure distribution of pertinent information. If very important, this is done immediately by telephone. Other means of relaying the information are by memos, Safety-Grams or Safety Bulletins.

Plant incidents ranging from near accidents to accidents and their investigations are reported on standard forms. Monthly reports on injuries are reported to the Safety Department. Serious incidents are covered immediately by phone. Details for this reporting are in Corporate Administrative Procedure 1.5(3), Safety Standard 625.0.1(1) and Plant Operations Manual 5.16(2), 5.18(4), and 5.21(5). These procedures and associated reports are used to obtain and relay information to applicable locations.



IVA-1 (Continued)

Quality control topics are also used occasionally as safety meeting material. There is some relationship with oxygen and other gases production as the mixing with other gases, lack of sufficient purity, and end uses could result in reactions hazardous to personnel and property. Low oxygen purity or inadvertent filling of oxygen containers with another gas could directly result in loss of life; for instance, in hospital breathing usage.

b. Printed Material

Facilities are provided with periodicals and safety papers as applicable to their operations. All facilities subscribe to National Safety Council material. Technical papers are purchased and distributed.

At one time the American Institute of Chemical Engineers annual symposium report on <u>Safety In Air and Ammonia Plants</u> was distributed to all facilities. However, the last four (there are twelve volumes) were essentially all limited to the ammonia plant and distribution was limited to New Orleans and a few key personnel in the Operations offices.

All facilities have copies of the Plant Operations Manual, one section of which is devoted entirely to safety. Operators have their own copy of this POM in the control room with the Safety, Quality Control, and Operations sections for their review and reference. Many times the new or revised procedures are covered formally in safety meetings.

Each facility also has two binders, one specifically for the AIChE symposium reports and another for all Safety-Grams and Safety Bulletins issued by the Safety Department. The Safety Manual also contains copies of miscellaneous technical papers applicable to our work.

For the last ten years all employees have been issued a pocket size Operations Safety Manual for ready reference. It includes the following sections:

Safety Organizations
General Safety Rules
Properties of Products
Safe Handling of Cryogenic Liquids
Safe Handling of Compressed Gases
Plant Operation and Maintenance Safety
Maintenance and Shop Procedures
Plant Housekeeping
Protective Clothing and Equipment
Chemicals
First Aid Instructions
Fire Protection
Office Safety



This pocket manual has been revised several times and reprinted. However, this past year it was decided to discontinue its use when the present supply is exhausted. Company growth, expanded operations, diversified products, etc. now make it impractical to include even the main items as revisions and additions are needed constantly. The POM does this job better and since it is available in all control rooms and is a looseleaf manual, it fills the bill adequately.

2. Area Placarding

Main placarding at air separation facilities are the No Smoking signs. Generally, there is no smoking permitted except in offices, control rooms and locker rooms, but areas of increased hazards may have additional reminders.

Other placards used as applicable are listed below:

- a. Fire Extinguishers May have bright red paint at the actual hanging area to facilitate location in emergencies and also act as an indicator to the fact that one belongs at that location so replacement can be expedited if necessary.
- b. "Authorized Personnel Only" Generally used in electrical bays only and in the immediate areas of oxygen compressors. Oxygen compressor areas are so posted to reduce personnel exposure to fire possibilities. Also, authorized personnel are familiar with the compressor and must first check operating conditions to be sure they are satisfactory before they spend any appreciable amount of time in the area.
- c. "Danger, Do Not Stand in Front of Cabinet While Motor is Being Started" These signs are posted on motor terminal boxes containing switches, lightning arrestors and capacitors rated 2500 volts or higher. There have been several incidents of explosions of this type of equipment. One man was hurt quite seriously in one case.
- d. "Danger, High Voltage" As applicable.
- e. "Danger No Smoking, Matches or Open Lights" Or similar sign in storage battery areas where hydrogen may be emitted.
- f. Exits As applicable for more remote escape routes.

- g. "Danger Caustic" and "Danger Acid" As necessary to applicable areas for purifier or water treatment.
- h. "Caution, May be High in Oxygen" For areas, such as in storage tank skirts where there may possibly be oxygen leaks and/or concentrations. Also, nitrogen tanks indicate there may be an asphyxiating atmosphere.

A good many other signs for normal industrial safety considerations are used, such as:

Fire Hose Emergency Shower Safety Glasses and Hard Hats Must be Worn Visitor's Parking Visitors Must Apply at Office Chemicals Goggles Must Be Worn in This Area

3. References

- (1) APCI, Industrial Safety Policy, APCI Safety Standards 625.01, October 3, 1961, (Doc. #99000241).
- (2) APCI, Industrial Safety Policy, APCI Plant Operations Manual Section 5.16, October 30, 1968, (Doc. #99000253).
- (3) APCI, Accidents Reporting, APCI Corporate Administrative Procedure, No. 1.5, April 1, 1968, (Doc. #99000254).
- (4) APCI, Safety Reports and Forms, APCI Plant Operations Manual, Section 5.18, March 3, 1970, (Doc. #99000233).
- (5) APCI, Accident Reporting, APCI Plant Operations Manual, Section 5.21, May 8, 1968, (Doc. #99000255).



IV. System Emergencies

B. Warning Devices

Warning devices for oxygen systems vary with process, application and vendors variations of similar equipment. However, most of the systems have some general applications. Unless otherwise noted, the summary below is for general applications.

Compressors - Oxygen

1. Process Stream

- a. Low pressure switch and alarm upstream in the suction of a centrifugal compressor to recycle the compressor if suction pressure decline continues to sub-atmosphere level. For reciprocating compressors, it will not recycle but will alarm and shut down.
- b. A low temperature switch and alarm on suction piping of any compressor taking suction from a possible cold source. Setting shall be based on area climate but in no case shall it be set below -5°F.
- c. A high temperature indicator-switch and alarm shall be provided on each stage discharge upstream of the cooler.

 Maximum permissible alarm and shutdown settings shall be 340°F and 350°F respectively. Each producing facility shall establish a lower setting when operating temperatures indicate this is possible. Alarm and shut down points shall then be 10°F and 20°F respectively above maximum normal summertime operating temperature.

2. Lubrication

- a. For centrifugal compressors, a high oil temperature indicator-switch, bulb type shall be installed in the oil return header from the bearings to the oil sump. The switch shall be connected to the alarm on the oxygen compressor instrument panel. The intent of this requirement is to warn the operator of excessive oil temperature due primarily to insufficient water flow.
- b. For reciprocating compressors, the high oil temperature indicator switch shall be in the oil return line from the cooler to the sump.



3. Motor

- a. The motor winding temperature indicator shall be located on the main instrument panel. A switch shall automatically shut down the compressor on excessive temperature.
- b. The motor cooling air temperature switch shall actuate an alarm located on the oxygen compressor panel in case of excessive temperature.
- c. Water-cooled motors shall be protected against internal water leakage from overhead coolers by a liquid-level switch connected to an alarm on the oxygen compressor panel or by a bottom drain continuously open to atmosphere.

4. Cooling Water

- a. A pressure switch shall be connected to actuate an alarm located on the main instrument panel, in case of abnormally low water pressure in the water pump outlet header.
- b. Loss of cooling tower fan operation shall be indicated by an alarm located on the main control panel.
- 5. Seal Gas System (centrifugal compressors only) A labyrinth system with nitrogen as a sealing gas is an integral part of centrifugal compressors to prevent bearing lubricating oil from reaching oxygen systems. Generally, at least a double protection is provided by these seal systems.
 - a. Pressure switches shall be provided to alarm and shut down the compressor when manufacturers' limits are exceeded for the following conditions.

Pressure at bearing end is too low
Pressure at injection part is too low
Pressure at impeller end is too high
Differential pressure between impeller and
injection part is too low

b. Seal gas backup system pressure is too low (alarm only)

NOTE: Backup system is provided in the event primary seal source has problems. Usually, the backup source is a cylinder supply with sufficient storage to get primary system working or shut down the compressor.



- 6. Rotor Shift (centrifugal compressors only) A rotor shift device is incorporated to indicate wear on the thrust shoes and if wear is excessive to shut it down. Normally, there is a bleed-through of gas in this system, but as wear on shoes progresses, it will permit it to touch the plunger which actuates a gear and permits a piston to drop. When this piston drops, it stops the bleed-through, builds pressure and actuates the alarm and shut down.
- 7. Vibration Centrifugal Compressor
 - a. Equipment shall be provided for monitoring radial vibration, axial vibration and axial position of each compressor rotor shaft and of the high speed pinion. This equipment shall be connected to the oxygen compressor instrument panel alarm. A switch shall shut down the oxygen compressor in case of excessive vibration at any point normally connected for continuous monitoring.
 - b. Continuously monitored vibration points shall be set for alarm and shut down at initial startup and every major overhaul as follows:

Maximum Normal Vibration +0.5 mil Alarm

Maximum Normal Vibration +1.5 mil Automatic Shut down

- 8. Vibration Reciprocating Compressors
 - a. Seismic type vibration switches shall be provided to shut down the compressor when frame vibration amplitude increases to twice the value at the new conditions as accepted by Machinery Engineering. A minimum of one switch per two crank throws is required. Each switch shall be wired to light a yellow light, which will indicate the switch that has shut down the compressor. The light shall be maintained until the switch is reset.

NOTE: The majority of the above information was extracted from APCI Design Engineering Standard 570.7, APCI Operated Oxygen Compressor System, July 19, 1971 (Doc. #99000256).

<u>Vaporizers</u>

1. Warm discharge side of vaporizers generally go into carbon steel piping. Temperature switches are applied here to sound alarms if piping gets too cold, usually due to



insufficient heating source (water or steam). The liquid source (pump or valve from a pressurized tank) is shut off at the same time the alarm is sounded.

- 2. Thermal Research Type Vaporizers (Natural Gas Fuel) Alarms and shut downs for this system are:
 - a. Low temperature switches, similar to Item 1 above.
 - b. Pressure switch to act in the event the natural gas supply pressure is low or high.
 - c. Low pressure switch for air blower.
 - d. High temperature switches for the downcomer in case of low water level.
 - e. High stack temperature switch, in case stack temperature is too high as a result of low water level.
 - f. Low water level switch.
 - g. Flow switch to act in case of failure of water pump.
 - h. CGA combustible gas analyzer to indicate incomplete combustion. Calibrated 0-2 percent total combustibles in an inert atmosphere.
 - i. Fire Eye to indicate no flame condition.

Pumps

- 1. Some of the older plants had low-pressure alarms on suction side of pumps to indicate loss of feed or low head to the pump. General use was on BJ type pumps.
- 2. New plants are now getting low current (amps) devices to indicate low suction pressure. Low pressure and low current switches are both to prevent cavitation and subsequent damage to the pumps, particularly bearings and shafts.

Product Lines

1. Some customer feed lines are provided with alarm indicating low pressure. Low pressure could be indicative of failure of some of our equipment, excess demands by the customer or



failure of the line. Excess flow valves are installed at a few older locations and most of the new plants whereby a line failure would also automatically shut off this valve. Excess flow valve is actuated by readout on a flow indicator across an orifice section. Ashland, Cleveland and Los Angeles have such systems. The Cleveland valve prevented a more serious incident some years ago when the customer had a fire in their reducing station and the excess flow valve was actuated.

Storage Tanks

1. Low pressure storage tanks have low pressure alarms, usually set at approximately 1 pisg, to warn operators if there is a tendency to approach vacuum conditions which could cause a tank collapse. Buildup coil system malfunction could result in lowering of pressure, particularly during withdrawal procedures.

General

1. It is our policy to install temperature switches in an area where carbon steel lines may be cooled down to -20°F or lower due to malfunctions of equipment. This is mentioned above for lines downstream of vaporizers, but is applicable in other areas. This same arrangement has been used where expansion of gas may cause excessive cooldown, but general rule here is to use proper materials of construction rather than the switch. Switch is tied into an alarm and/or applicable systems shut down to prevent further cooling.



IV. System Emergencies

C. Protection

1. Personnel

The adequacy of personal protective equipment is insured by testing and maintenance as required by APCI, Plant Operations Manual 1.12 (1).

a. Eye Protection

Safety glasses must be worn at all times in areas such as operating areas, cylinder filling areas, and near any grinding or cutting operations.

Glasses must be worn by office personnel or visitors when in these areas.

Working around welding operations, flash goggles with side shields must be worn.

Employees who normally wear prescription glasses may obtain safety spectacles, made according to their prescription through the company.

Face shields and chemicals goggles must be worn during mixing or transferring of corrosive materials.

Goggles must be used when using a stationary or portable grinder.

Chemical goggles must be used during any operations requiring the use of solvents or cryogenic liquids. Additional eye and face protection may be required in some locations for special reasons.

References Safety standards Sec. 627.4.2 (2), Safety-Grams No. 1 (3), 29 (4), 30 (5), and 58 (6).

b. Hard Hats

Safety hats-caps must be worn by all operating personnel around machinery, operating areas, and storage areas. The only exempted areas are the office, control rooms, and locker rooms.

Visitors, office personnel, and maintenance men are required to follow the same instructions as above.



Safety hats-caps are excellent protection against falling objects.

The wearing of hard hats is mandatory at all operating facilities.

Reference Safety Standard Sec. 627.4.1 (7).

c. Safety Shoes

Realizing the importance of safety shoes, the company contributes toward the purchase of safety shoes and recommends their use. Injury records prove the reduction in the frequency and the severity of foot injuries by personnel wearing safety shoes. Safety shoes are not mandatory, but are urged and recommended at all facilities.

Reference Safety-Gram No. 11 (8).

d. Respiratory Protection

Filter-type respirators are to be used when working in dusty areas or when handling dust-producing materials such as rockwool or perlite.

Respirators equipped with "rebreathers" in which the wearers breath is passed over alkali peroxide to replace oxygen and remove carbon dioxide, should not be used in trichlorethylene service. Reaction of trichlorethylene with the caustic formed during the regenerating reaction leads to the formation of dichloracetylene, which is highly toxic and explosive.

Self-contained or air-line breathing apparatus is to be used in any area where there is a high concentration of solvent vapors or where the oxygen content of the atmosphere is below 18 percent. Life lines will be used except when otherwise instructed. Areas to be considered are, internal cleaning of storage tanks and vessels, and entry of cold boxes with nitrogen atmosphere when using cleaning solvents.

Reference Safety Standard Sec. 627.3 (9).

e. Hearing Protection

Operations Department has been supplying hearing protection equipment as needed or requested for a number of years. Wearing of this equipment is now mandatory largely where the occupational noise level exceeds 90 decibels as measured on the "A" scale of a standard sound level meter at slow response, regardless of octave band. Sound level surveys are made at each location and safety meetings are held with employees.



Safety meeting outlines include: Reasons for concern, sound measurement, exposure limitations, parts of the ear and their function, and where protection should be worn. Generally, ear plugs are satisfactory, but ear muffs are recommended where noise levels reach 110 decibels. There may be occasions where the decibel level may exceed 130, for these exposures both the ear plug and the ear muff shall be provided and used.

Reference Safety Standard Sec. 627.4.8 (10), Memo Operations Hearing Protection Program, H. Master, Dated 4/7/71 (11), Safety Standard Sec. 625.0.1.2 (12).

f. Gloves

Neopreme or suitable plastic gloves are to be worn during handling of solvents, acid, or other harmful chemicals.

Approved gloves with gauntlets are to be worn during cryogenic liquid transfers or handling.

Approved gloves for electrical service are supplied. These are high voltage lineman's gloves and lineman's leather protector gloves.

Gloves are also supplied for normal every day use.

g. "Check In" Systems

The Safety Department recommends the guidelines listed be utilized in establishing the controls to provide a means of checking on the conditions of personnel who are working alone, performing emergency maintenance work or daily routine operations. Obviously where a "check-in" system can be established with a near-by Air Products facility, customer personnel, or neighboring industry guard service, such an arrangement shall be made. The hazards inherent in the type of work being performed by the individual shall be the criteria used in determining whether a "check-in" system is required.

Flammables-Regularly scheduled operations with one man/shift at any facility handling flammables must be provided with a positive method of "check-in" by the operator. The frequency of "check-in" may vary with the type of system established but must provide a minimum operator "check-in" once every hour.



Oxygen - A "check-in" system for one man/shift operation is required if routine operations necessitate operation from more than grade elevation or if cryogenic liquid loading operations are performed. The frequency of "check-in" shall be a minimum of once every hour.

Maintenance - Maintenance work on systems containing flammable gases will require the presence of more than one person.

Maintenance work on energized electrical systems with voltages up to 250 volts will require the presence of more than one person. Under no circumstances are personnel permitted to work on energized circuits with voltages exceeding 250 volts. Work on de-energized circuits with voltages of 440 volts or above will require the presence of more than one person. The second person need not be an electrical technician.

Acceptable "check-in" systems - The "check-in" system utilized shall be a reliable method of determining the responsiveness of an individual.

The A.D.T. system is used at many facilities. A switch must be actuated every hour or an alarm is flashed in the A.D.T. office. They in turn call the plant and if there is no answer they will investigate or call facility management.

The telephone system, by being called or by calling another facility, or a guard service hourly..

Reference Kitson, F. K., Staffing and "Check-In" Systems for Operating Plants, June 25, 1968 (13).

h. First Aid Instructions

All injuries, no matter how slight, must be reported to facility management, and shall be treated immediately.

A first aid record must be kept of all injuries, their cause, and the first aid treatment.

First aid kits are not a substitute for dispensary or medical treatment. It is merely the first step in preventing a bad situation from becoming worse.

Know the location of stretchers, first aid kits, fire blankets, and other first aid equipment.

Know the emergency numbers or where they can be found for doctor, hospital, and ambulance service.



First aid is no substitute for proper medical attention.
Injuries of any magnitude must be referred to a competent physician after first aid treatment.

Minor injuries: treat accordingly as listed under first aid guide or refer to the Red Cross First Aid Manual, which is available in all first aid cabinets. If there is any doubt to the seriousness of the injury, the patient should be driven to the doctor after first aid treatment. Make notations with full particulars on the first aid record sheet.

Serious injuries: call for a doctor and/or ambulance immediately. Be sure to keep the patient warm and lying down. Attend to serious bleeding immediately and give artificial respiration if necessary. Do not move the injured person unless absolutely necessary. Contact management as soon as practical.

i. Evacuation Routes

Management of each APCI facility prepares a plan for quickly evacuating all areas in an orderly fashion and in a minimum of time. The plan, clearly identifying all evacuation routes and exits, is posted at convenient locations in all areas.

Personnel are trained to direct an orderly evacuation and to secure their area before leaving.

The evacuation plan is reviewed and revised every six months or less if conditions arise which warrant changing the plan.

2. References

- (1) APCI, Personal Protection Equipment Maintenance, APCI Plant Operations Manual 1.12, April 21, 1967 (Doc. #99000104).
- (2) Smith, H. W., Personnel Protective Equipment, Eye Protection, APCI Safety Standards 627.4.2, October 1962, (Doc. #99000316).
- (3) APCI, Pressure Gauge Failure, Safety Glasses Save Another Pair of Eyes, APCI Safety-Gram No. 1, June 1, 1961, (Doc. #99000317).
- (4) Smith, H. W., Safety Equipment Never Prevents an Accident —— It only Prevents an Injury, APCI Safety-Gram No. 29, August 1, 1963 (Doc. #99000318).



- (5) Ball, W. L., Are Safety Glasses Worth the Cost and Effort?, APCI Safety-Gram No. 30, August 9, 1963 (Doc. #99000329).
- (6) Schmoyer, W. W., And Then There was Darkness, APCI Safety-Gram No. 58, March 15, 1967 (Doc. #99000319).
- (7) APCI, Personnel Protective Equipment, Wearing Apparel, Hard Hats, APCI Safety Standards 627.4.1, June 15, 1970 (Doc. #99000320).
- (8) APCI, Safety Shoes, APCI Safety-Gram No. 11, May 14, 1962 (Doc. #99000321).
- (9) Smith, H. W., Personnel Protective Equipment, Respiratory Protective Equipment, APCI Safety Standards 627.3, January 1964 (Doc. #99000322).
- (10) APCI, Personnel Protective Equipment, Occupational Noise Protective Equipment, APCI Safety Standards 627.4.8, September 1969 (Doc. #99000323).
- (11) Master, H. H., Operations Hearing Protection Program, April 7, 1971 (Doc. #99000324).
- (12) APCI, Industrial Safety, Occupational Noise, APCI Safety Standards 625.0.1.2, April 9, 1971, (Doc. #99000325).
- (13) Kitson, F. K., Staffing and "Check-In" Systems for Operating Plants, APCI Safety Dept. Memo, June 25, 1968 (Doc. #99000326).



IV. Systems Emergencies

C. Protection

2. Buildings and Adjacent Systems Protection

a. Deluge Systems:

Deluge Systems are used at cryogenic liquid loading facilities where daily transfer operations are conducted on a routine basis.

A spray nozzle is provided at each liquid loading connection. The adjustment of the nozzle depends on available G.P.M. capacity and pressure of fire water system. The nozzle pattern is set for full coverage of the rear of the trailer with sufficient angle to allow for the trailer to be spotted off center from the loading connection. The system is provided with an air operated block valve which is actuated from at least two remote positions or a manual valve when the valve can be located in a safe operating area.

References: Safety Standards Sec. 630.2.6 (1)

b. Barriers:

Protective barriers of single sheet corrugated steel are erected around most stationary liquid oxygen pumps, (B.J. pumps excluded).

The protective barriers are installed in such a manner that the operator will be protected from metal parts, liquid, or a fire in the event of a pump failure and fire.

The protective barriers, for oxygen gas compression systems, vary due to the size and type of compressors, and are fully covered in the APCI Design Standards.

References: Stompler, R. D., LOX Pump Safety Barriers, February 19, 1971 (2)

APCI Design Engineering Standards 546.1 (3)

APCI Technical Bulletin No. 42 (4)

c. Fire Protection:

The guides for fire protection are based, where possible, on National Fire Protection Association Codes, the Insurance Carrier, and The Company Standards. In all instances fire



protection at the facilities exceed the requirements of the insurance carrier.

The first consideration for a fire water system is the availability of water, its source, volume and pressure.

Hydrant locations are based on the specific exposure in the facility. Generally, they will be located at least a minimum of fifty feet from the exposure.

Each hydrant has a house and is equipped with double doors which open outwards. The standard equipment for each house includes a spanner and hydrant wrench, hose straps, hose fittings, nozzles, and hoses.

Normally the facilities have a small complement of men, with this in mind the hose equipment provided is designed for ease of handling.

The facilities are instructed to follow the rule of calling outside help first then combating the fire. If help is available naturally fire fighting equipment is put into service while one employee phones for assistance.

Portable fire extinguishers are located according to what is considered to be possible problem areas in the facility. The two types used are the Dry Powder and Carbon Dioxide extinguishers. The inspection of these are on a regular schedule by the employees with the duty rotated to keep each man acquainted with the locations.

Monthly safety meetings are conducted at each facility with each employee explaining the fire fighting equipment along with personnel safety.

References: APCI Operations Safety Manual (5)
APCI Plant Operations Manual, Section 1.13 (6)
C.G.A. Report by M. H. Hubbs, pp. 175-189,
Oct. 15 and 16, 1963 (7)
APCI Safety Standards 605.1 (8)
APCI Safety Standards 605.1.3 (9)
APCI Safety Standards 610.1.1 (10)
APCI Safety Standards 625.0.1 (11)
APCI Safety Standards 625.0.1 (11)
APCI Safety Standards 626.3.8 (12)
APCI Safety Standards 627.4.7 (13)
APCI Safety Standards 627.5.1 (14)
APCI Safety Standards 630.2.2 (15)
APCI Safety Standards 630.2.3 (16)

APCI Safety Standards 630.3.2 (17)



d. References:

- (1) Kiston, F. K., Fire Protection Equipment, Deluge System, Deluge System, LOX Loading Facility, APCI Safety Standards 630.2.6, January 1964 (Doc. #99000055).
- (2) Stompler, R. D., LOX Pump Safety Barriers, APCI Memo, February 19, 1971 (Doc. #99000327).
- (3) APCI, Personnel Protective Shields, Oxygen Systems, APCI Design Engineering Standards 546.1, January 15, 1971, (Doc. #99000025).
- (4) APCI Technical Bulletin No. 42 Applicable to Design Engineering Standards 546.1, September 30, 1971, (Doc. #99000238).
- (5) APCI, Operations Safety Manual, APCI 20P64 (Doc. #9000330).
- (6) APCI, Maintenance of Portable Fire Extinguishers, APCI Plant Operations Manual, Sect. 1.13, March 30, 1967 (Doc. #99000331).
- (7) Hubbs, M. H., Fire Protection, Air Separation Plant Safety Symposium, P. 175 to 189, CGA Meeting, Chicago, Ill., October 15 and 16, 1963 (Doc. #99000332).
- (8) Ball, W. L., APCI Plant Site Criteria, Air Separation, APCI Safety Standards 605.1, November 10, 1960 (Doc. #99000042).
- (9) Ball, W. L., Criteria, Air Separation Plants Layout, APCI, Safety Standards 605.1.3, January 6, 1961 (Doc. #99000043).
- (10) Ball, W. L., Check List, Air Separation Plant Site, APCI Safety Standards 610.1.1, November 28, 1960 (Doc. #99000052).
- (11) Ball, W. L., Industrial Safety Policy, APCI Safety Standards 625.0.1, October 3, 1961 (Doc. #99000241).
- (12) APCI, Safety Control Procedures, Emergency Procedures, APCI Safety Standards 626.3.8, May 1962 (Doc. #99000053).
- (13) APCI, Personnel Protective Equipment, Aluminized Heat Protective Clothing, APCI Safety Standards 627.4.7, May 1968 (Doc. #99000333).
- (14) APCI, Personnel Protective Equipment, Tonnage Air Separation Plant, APCI Safety Standards 627.5.1, June 14, 1970 (Doc. #99000334).



- (15) Smith, H., Fire Protection Equipment, Outside Fire Hydrants, APCI Safety Standards 630.2.2, July 26, 1961 (Doc. #99000244).
- (16) APCI, Fire Protection Equipment, Outside Hydrant House and Equipment, APCI Safety Standards 630.2.3, June 15, 1970 (Doc. #99000245).
- (17) APCI, Fire Protection Equipment, Inside Outside, APCI Safety Standards 630.3.2, May 1968 (Doc. #99000246).



LIQUID AND GASEOUS OXYGEN SAFETY REVIEW DATA

IV. System Emergencies

E. Hazards Protection

One of the prime considerations when locating a new facility is the immediate industry in the area. A survey is made within a substantial radius of the proposed site to eliminate trouble areas that could not be controlled. There are instances where undesirable industry has located next to one of APCI facilities and precautionary measures must be undertaken. Listed below are a few instances where this has occurred and the action taken to protect equipment and personnel.

The Delaware City facility had a chlorine plant built adjacent to it. The first thing that is normally done is to get to know the hazards involved such as possible spills, abnormal process vents and possible line ruptures. This is usually done by a meeting with the new facility management and receiving a firm agreement to be notified immediately in the event of an emergency. APCI has purchased 20 masks which is a sufficient number to protect the maximum personnel in the plant at any one time. The masks are for escape from the area and not for prolonged exposure. Self-contained breathing type masks were purchased for prolonged exposure and are used by operators to secure the facility.

All personnel are advised on the use of the masks and the hazards involved. Escape routes are posted and an alterante gate was installed for emergencies.

The procedures for emergency shutdowns are posted and take minimum time.

The escape type masks are the Willson Double-Cartridge Filter Series 800C with the #43 cartridge. These are for maintenance type personnel and are used for immediate evacuation of the area.

The prolonged exposure type masks are the 272-0VAG-L with full face as manufactured by Acme Protection Equipment Co. This type is effective for an adequate period of time to permit securing the equipment in a safe and orderly manner.

The Alcoa, Tennessee installation had a chlorine storage tank located in the immediate vicinity. The concern again was mainly to supply suitable gas masks and proper instructions to the personnel located at the facility. This installation is a one man operation. The type mask used here is the Scott Scapak, Model 9000 11-03 with an extra cylinder. This gives the man sufficient time to secure the facility in an orderly manner. The Willson



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TLGW mask with LG3 cannister case is available for maintenance personnel which could be on site, and they would be expected to evacuate immediately.

The new Martinsville, West Virginia installation had a problem with a neighboring facility venting large amounts of NO_2 gas. The neighbor at the time was having what is considered normal start-up problems and have since remedied these. The neighbor also stores phosgene gas at the facility. We have purchased sufficient number of gas masks and posted emergency procedures.

Where a facility is located in a extreme hazardous area, such as in a storage area containing flammable liquids, we would consider installing a system which would provide a curtain of water between the hazard and the facility. This is of course considered an extreme case.

The protection and precautions taken are decided upon, after the hazards from neighboring facilities are studied. The facilities are equipped with proper type portable fire extinguishers. The larger facilities have fire water loops and hose houses located strategically.



LIQUID AND GASEOUS OXYGEN SAFETY REVIEW DATA

IV. Systems Emergencies

E. Hazards Protection

The following APL bulletins and reports identify and discuss various problems related to oxygen safety:

- (1) Everson, I., Notes for Guidance of Customers Having Air Products Ltd. Oxygen Equipment, APL Safety Department Information Sheet No. 19, (Doc. #99000422).
- (2) Everson, I., Fire Hazards in Compressed Air and Oxygen Rich Environments, APL Safety Department Information Sheet No. 33, (Doc. #99000423).
- (3) Denison, D. M., An Assessment of the Fire Risks of the Oxygen Environment Experiments, RAF Institute of Aviation Medicine, Farnborough, Hants, FPRC/Memo 217, January 1965, (Doc. #99000424).
- (4) Denison, D. M., J. Ernsting, and A. W. Cresswell, The Fire Risks to Man of Oxygen Rich Gas Environments, RAF Institute of Aviation Medicine, Farnborough, Hants, FPRC/Memo 223, July 1965, (Doc. #99000425).
- (5) Denison, D. M., and W. J. Tonkins, Further Studies Upon the Human Aspects of Fire in Artificial Gas Environments, RAF Institute of Aviation Medicine, Farnborough, Hants, FPRC/1270 September 1967 (Doc. #99000426).
- (6) Everson, I., Hazard Level of Hydrocarbon Films in Oxygen Systems (Important Data Extracted from a Paper Presented by W. L. Ball (APCI) at the AIChE Annual Meeting, Air and Ammonia Plant Symposia, September 25-27, 1961), APL Safety Department Information Sheet No. 41, April 8, 1971, (Doc. #99000427).
- (7) Everson, I., Limiting Values of Oil Contamination of Stainless Steel Surface Exposed to Gaseous Oxygen, APL Safety Department Information Sheet No. 42, April 8, 1971, (Doc. #99000428).

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LIQUID AND GASEOUS OXYGEN SAFETY REVIEW DATA

V. Accident/Incident Investigation and Report

Accidents Involving Spills and Leakage

It has been Air Products' experience that accidents involving liquid oxygen tankers and oxygen tube trailers do not result normally in a loss of product. There have been occasions when the liquid oxygen tanker has been damaged to the extent that transfer from the damaged vehicle was believed to be necessary. If the product cannot be completely transferred into another tanker it is our practice to add liquid nitrogen to the "heel" of liquid oxygen remaining in the disabled vehicle to bring the residual liquid to a liquid air concentration. The remaining heel of liquid air is then discharged to a safe location.

The infrequent LOX spills which have occurred within IGD have not resulted in a serious problem. The most recent occurred on February 24, 1971, when approximately 2,5000 gallons of LOX discharged from a 6,000 gallon tank. The direction of vapor drift and flow was controlled by fire hose streams to prevent the oxygen vapors from drifting toward a residential section. Water was not sprayed on the liquid oxygen.



LIQUID AND GASEOUS OXYGEN SAFETY REVIEW DATA

V. Accident/Incident Investigations and Reports

Accidents involving oxygen equipment and systems which cause injury to personnel or damage to equipment and property are thoroughly investigated to determine the cause and the corrective action necessary to prevent recurrences.

A. Reporting Requirements

Corporate Administrative procedure requires reporting all accidents to the various managers of departments and divisions, the Corporate President, and the Safety Director. The more serious accident is initially reported by telephone and followed by the appropriate form reporting requirements. The less serious accidents are reported by submitting the forms required. Accidents involving personnel or property of third parties (customer, general public, etc.) are reported by telephone to the responsible managers including the Law Department.

Forms used to report injuries to personnel contain information as required by federal, state or local governments, workmen's compensation; and/or by the insurance carrier. Copies of typical forms are attached. Equipment damage report forms may be memoranda describing the accident or incident.

B. Investigation of Accidents

Each accident involving oxygen and/or oxygen equipment is investigated to determine cause and corrective measures necessary to eliminate or minimize the possibility of recurrence. The extent of the investigation is determined by the type equipment involved and the extent of injury to personnel. The level of investigation for an oxygen gauge failure which caused personnel injury will be greater than a gauge failure which does not involve personnel injury. On the other hand, an accident involving an oxygen compressor or an air separation plant is extensively investigated whether personnel are injured or not because of the economic and technical significance to other Company operating areas.

The investigation of accidents may be made by a competent individual or by teams of specialists, including consultants, using available techniques in determining the mechanics of reaction which caused the accident.

Accidents which occur to oxygen equipment manufactured, owned, and/or operated by other companies and industries are investigated to the extent possible on information obtained through news media, confidential correspondence, professional society symposiums, and federal agencies.

C. Records

Records are maintained on all accidents pertaining to oxygen and/or oxygen equipment which occur within our Company and users of equipment manufactured by our Company. Records of accidents occurring to other companies are also maintained.

For convenience of identification and record retrieval, categories of oxygen equipment failures have been established as follows:

- 1. Air Process Plants
 - a) General
 - b) Reboilers
- 2. Oxygen Compressors
- 3. Liquid Oxygen Pumps
- 4. Oxygen Regulators and Related Equipment (Torches)
- 5. Piping and Lines
- 6. Storage Systems
- 7. Gauges and Instrumentation
- 8. Highway and Rail Tankers

Summaries of accidents in each equipment category are maintained and periodically reviewed:

D. Summary of Accidents

The attached summaries are identified to be in agreement with the categories established in paragraph "C". The column headings on the summaries indicate the date of accident, location of accident by State or Country, equipment owned and operated either by "APCI" or "other" companies with similar activities, component and/or plant size where applicable, and a remarks column which briefly summarizes the accident. The summary applicable to oxygen regulators and related equipment pertaines only to equipment manufactured by APCI.

1. Air Process Plants

a) General

Table VDla lists accidents to air plants and identifies the component involved where the reaction occurred.

Analysis of each accident led to recommendations to minimize or eliminate the possibility of recurrence.

Review of the summary indicates retraining was necessary in the case of the IT/D plants. Limitations on the oxygen content of reactivation nitrogen for the 75T/D plants, plus some procedural and instrument design changes essentially eliminated air drier type of fires. Establishment of plant washout programs minimized the possibility of expansion



engine oil absorber reactions. Analyzing contaminant concentrations in process streams and establishing limits of contaminant levels has improved the operating record of air plants. Established preventive maintenance programs has further reduced the possibility of accident recurrence.

b) Reboilers

Table VDlb lists the accidents occurring to air process plant reboilers as a group. The column heading "reboiler type" is letter coded as follows:

- A. Shell and Tube (internal to column) Oxygen or crude oxygen is on the shell side and nitrogen gas is condensed in the tubes.
- B. Thermo-syphon Reboiler (external to column) Shell and Tube. Oxygen passes through the tubes from bottom to top and nitrogen is condensed on the shell side.
 - C. Extended Surface (Plate and Fin) Reboilers (external to column). Oxygen passes upwards in its passages and nitrogen passes downward through its passages.
 - D. Extended Surface (Plate and Fin) Reboilers (Internal to Column). Oxygen passes upwards in its passages and nitrogen passes downward through its passages.
 - E. Extended Surface (Plate and Fin) Reboilers (Internal to Column). Same as "D" but crude oxygen instead of oxygen.
- F. Modified Single Column. Small packed exchangers operating at elevated pressure and attached to a low pressure single column for the purpose of condensing nitrogen reflux streams.

Early plant reboiler failures led to the development of the hydrocarbon analyzer to constantly monitor hydrocarbon in process streams. A quick spot check test for acetylene concentration in plant liquids also came into regular use. Operating changes include disposing of given amounts of plant liquids continuously or at regular intervals to remove contaminants. Some design improvements evolved as a result of reboiler failures.

2. Oxygen Compressors

Table VD2 lists oxygen compressor reactions which have occurred in recent years. A series of reactions have occurred during World War II with water lubricated oxygen compressors and driers due to incompatibility of materials used.



To minimize the damage from reaction, inlet suction screens, vibration detectors, temperature sensors, and automatic inventory dumping valves have been provided. Erection of barriers, and remote operation control are intended to provide protection for operating personnel. Startup and shutdown on nitrogen is routine operating practice.

3. Liquid Oxygen Pumps

Table VD3 lists pump accidents which are identified as plant or trailer mounted and centrifugal or reciprocating pumps.

Contamination or improper materials appears to be the chief cause of reciprocating pump failures. Centrifugal pump failures are related to mechanical failure of bearings and their lubrication which cause interference between pump parts and case. Design changes involving opening of pump clearances and different materials have been made to minimize the accident recurrence potential. A strict preventive maintenance schedule will cause bearings to be changed before they can become a problem.

4. Oxygen Regulator Accidents

Table VD4 lists regulator accidents which have occurred to APCI manufactured equipment. This class of oxygen equipment is widely used by many people from all walks of life. Most accidents have been caused by actions of persons who do not fully understand the hazards associated with the use of oxygen.

Training is thy key to minimizing the possibility of recurrence of this type accident. Improvement in operating instructions and discussions and demonstrations to industry and technical schools are efforts being made to train as many people as possible.

5. Piping and Lines

Table VD5 lists accidents which have occurred in oxygen piping and line systems. Most accidents are associated with persons unfamiliar with the hazards of oxygen. Training becomes the key to minimizing accidents with this class of equipment.

6. Storage Systems

Table VD6 lists only the major storage system failure accidents which are significantly important to total system safety.



7. Gauges and Instrumentation

Table VD7 lists accidents related to gauges and instrumentation failure. Those accidents pertaining to gauges are associated with contamination due to testing media or handling and storage when not in use usually introduced by persons not fully aware of the hazards associated with oxygen service. Training is the key to minimizing these accidents.

8. Highway and Rail Tankers

No entries are made in Table VD8. Highway and rail tankers have been damaged in accidents, however, the damage resulted not from tank failure but rather from involvement in vehicle or train derailment incidents.

Date of Accident	Location of Accident	Equip. Owned or Operated	Plant <u>Size</u>	Plant Component	Page 1 of 4 Remarks
10/56	Virginia	0	lT/D	H.P. Column	Column ruptured by overpressurization through misoperation and violation of safety practices——gagging of a safety relief valve. H.P. column extensively damaged, cold box and low pressure. Column slightly damaged. No injuries.
12/3/56	W. Virginia	0	Tonnage	Disposal Vaporizer	Energy release in a purge stream from condensers occurred in vaporizer coils. Believe contaminant concentrated in coils under restricted flow. Ignition source and contaminant unidentified. Localized damage only. No injuries reported.
7/11/57	California	A	75T/D	Air Drier	Fire in air drier from oxygen enriched reactivation nitrogen and hot drier. Fire occurred after start-up from a cold shutdown. Damage restricted to drier without burn through. No injuries.
7/12/57	California	, A	75T/D	Air Drier	Fire in No. 2 oil separator from oxygen enriched reactivation nitrogen and hot drier. Fire occurred after startup from a cold shutdown. Damage restricted to drier without burn through. No injuries. Operational procedure changes eliminated this potential hazard.
3/6/58	Florida	0	lt/d	L.P. Column	Column ruptured by overpressurization. Line(s) from H.P. column believed to be partially restricted. Damage to H.P. column was extensive. One person was slightly injured.
3/30/58	Texas	0	Tonnage	Total Plant	Leaking LOX from drain line impinged upon carbon steel air line which ruptured in trench containing some oil. Extensively damaged the compressor building, including the control room of the plant. Three (3) persons were killed.
2/9/59	California	А	75T/D	Air Drier	A fire occurred in the No. 2 oil separator when process air was introduced in a hot (above 400°F) separator. Minor internal separator damage. No injuries.

Date of Accident	Location of Accident	Equip. Owned or Operated	Plant Size	Plant Component	page 2 of 4 Helica de la companio del companio de la companio de la companio del companio de la companio del companio de la companio de la companio de la companio de la companio del companio de la companio della com
4/21/59	England	0	Tonnage	Cold Box	Explosion in air plant cold box external to process equipment caused extensive plant damage and three (3) fatalities. The reaction was determined to be between LOX and oil soaked rock wool. Reported in AIChE Safety in Air and Ammonia Plants, Volume 2, page 36 (Doc. #99000295), and Volume 5, page 1 (Doc. #99000103).
1/4/61	Germany	0	Tonnage	Total Plant	LOX leak penetrated to smoldering wood flooring underneath cold box plates. Extensive damage to entire plant and 15 fatalities occurred. Reported in AIChE Safety in Air and Ammonia Plants, Volume 4, page 70 (Doc. #99000294).
7/61	England	0	lt/D	L.P. Column	Explosion in top 6 trays of L.P. Column. Details lacking but believe overpressurization involved rather than reaction. Slight damage to cold box. No injuries reported.
8/15/61	Michigan	0	25 T/ D	Air line at driers	Fire at driers due to customer cross-tie of oxygen and nitrogen lines. Unapproved field modifications. Damage restricted to piping at driers. No injuries.
1/14/62	Texas	0	100T/D	Piping	Explosion and fire in drain valve and defrost header on pure oxygen filter. Equipment damage slight. One (1) fatality.
1/26/62	Florida	0	1T/D	L.P. Column	Column ruptured by overpressurization through mis- operation. Suspected faulty liquid level gauge permitted excessive liquid levels in low pressure column.
5/20/62	England	0	Tonnage	Vaporizer	Reaction between oil and oxygen in LOX disposal vaporizer. One (1) fatality and two (2) injured.
5/26/63	Delaware	A	Tonnage	Expansion Engine Oil Separator	Fire in reciprocating expander oil separator at start of reactivation cycle. No equipment damage or personnel injuries.

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AIR PROCESS PLANT ACCIDENTS

V-2 (continued)
Table VDla
Page 3 of 4

					Page 3 of 4
Date of <u>Accident</u>	Location of Accident	Equip. Owned or Operated	Plant Size	Plant Component	Remarks
7/12/63	Ohio	A	75T/D	Air Drier	Air drier heated box ruptured from overpressure due to leaking H.P. drier valve. Slight damage confined to the drier accessories. No injuries.
9/63	Engl a nd	A	100T/D	Air Drier	Drier dust filter involved in fire when air was used to cool down a hot drier vessel. Damage confined to drier filter and piping. No injuries.
12/19/63	Canada	0	Tonnage	Oil Separator	Reaction with air and oil at -265°F in expansion engine oil-knock out pot. Moderate damage to separator and associated piping.
9/17/64	England	Α	Tonnage	Argon Plant	Hydrogen reaction with oxygen in Deoxo unit. Faulty operation. Damage sustained to vessel support legs and concrete foundation. No. injuries.
2/3/65	California	A	75T/D	Expansion Engine	Mechanical failure of engine valve spring and higher than normal oxygen content of process gas reacted with oil accumulation in discharge piping. Piping and valve system extensively damaged. Slight area damage to building and other equipment. No injuries.
3/4/65	Delaware	Α	Tonnage	Expansion Engine	Reaction in expansion engine oil absorber filter carried into piping system. Damage was restricted to piping system and filter media. No. injuries.
9/2/65	Pennsylvania	A	34T/D	Safety valve header	LOX spilled from unattended automatic plant through hole in S.V. header after SV functioned. Design error.
12/22/65	Micnigan	0	Tonnage	Vaporizer	Solvent remaining in vaporizer after being cleaned reacted with oxygen when vaporizer placed in service. The vaporizer was extensively damaged. Two (2) fatalities occurred.
1/67	Illinois	0	Tonnage	Auxiliary Column	Reaction in auxiliary column. Details lacking.

AIR PROCESS PLANT ACCIDENTS

V-2 (continued) Table VDla page 4 of 4

Date of Accident	Location of Accident	Equip. Owned or Operated	Plant <u>Size</u>	Plant Component	Remarks
7/7/67	Delaware	Α	Tonnage	Expansion Engine	Reaction occurred in oil separator filter. Damage was confined to filter element within the separator vessel. No injuries.
9/18/67	Pennsylvania	0	Tonnage	Hydrocarbon Adsorber	Reaction in hydrocarbon adsorber area. Reaction between oxygen and retained trichlene solvent from previous washout.
10/6/67	Indiana	0	17T/D	Heat Exchanger Air Header	H.P. Air line ruptured at heat exchanger. Erosion of line caused by water vapor in air circuit. In service 17 years.
1/10/68	Texas	0	350T/D	Heat Exchanger	Reaction in oxygen circuit of coiled tube heat exchange in dead end of header where fuels could accumulate. Damage was restricted to one end of oxygen header. No injuries.

^{0 =} Other Companies

A = Air Products & Chemicals

REBOILER REACTIONS

		т	77	703	Dob - 27	Page 1 of 3
_	Date of Accident	Location of Accident	Equip. Owned or Operated	Plant <u>Size</u>	Reboiler <u>Type</u>	Remarks
1	./11/56	Texas	0	Tonnage	Α	Reboiler reaction caused by nitrous oxide - acetylene crystals. Reported in AIChE, Safety in Air and Ammonia Plants, Volume 2, page 31 (Doc. #99000296).
).	1/18/56	Pennsylvania	0	Tonnage	В	Ethylene and hydrocarbons concentrated in the reboiler and reacted causing extensive damage to air plant cold box, nitrogen wash column cold box, and accessories in the immediate vicinity. Personnel injury occurred.
8	3/57	Germany	0	Tonnage	?	Reboiler reaction caused by hydrocarbons from hot air compressor.
4	4/24/58	Canada	0	100T/D	В	Reboiler reaction. Acetylene believed to be involved. Falling oxygen in tubes. A single reboiler tube involved. Reported in AIChE, Safety in Air and Ammonia Plants, Volume 3, page 9 (Doc. #99000297).
1	-/59	Philippines	0	.6T/D	. F	Distillation column reaction. Acetylene in column sump believed to be cause due to acetylene plant location.
2	2/26/59	Brazil	0	.75T/D		Distillation column reaction. Details unknown.
7	7/15/59	New Jersey	A	6.5T/D	A	Slight reboiler reaction possible due to accumulations of hydrocarbons from poor compressor operation and no plant washout. Only indication of reaction was loss of purity. Slight bulge in reboiler shell at bottom tube sheet. No injuries.
8	3/28/59	South Dakota	0	lt/D	A	Rupture of joint between high & low pressure column. In- sufficient detail to determine cause of reaction.

REBOILER REACTIONS

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Date of Accident	Location of Accident	Equip. Owned or Operated	Plant Size	Reboiler Type	page 2 of 3
9/30/59	Canada	0	100T/D	$\mathbf{B}_{i = j^{k}}$	Reboiler reaction. Acetylene believed to be involved. Falling oxygen in tubes. Cold box extensively damaged. No injuries. Reported in AIChE, Safety in Air and
					Ammonia Plants, Volume 3, page 9 (Doc. #99000297).
11/59	Texas	0	20T/D	? .:	Reboiler reaction. Details unknown.
4/20/60	West Virginia	0	Tonnage	C or D	Reboiler reaction. Dry boiling in oxygen passages. Reported in AIChE, Safety in Air and Ammonia Plants, Volume 3, page 12 (Doc. #99000298).
2/20/61	Mexico	0	2.5T/D	A	Reboiler explosion when contamination reacted due to H.P. oxygen used to unplug lower liquid level line.
3/61	England	0	1T/D	А	Reboiler reaction, cause undetermined.
5/62	West Virginia	0	Tonnage	C or D	Reboiler reaction. Dry boiling in oxygen passages.
8/62	Michigan	0	500T/D	C or D	Reboiler reaction. Dry boiling in oxygen passages.
11/62	Peru	0	.75T/D	F	L.P. Column sump and tray damaged in explosion. Details unknown.
11/63	Ohio	0	Tonnage	C or D	Reboiler reaction. Dry boiling in oxygen passages.
2/64	West Virginia	0	Tonnag e	C or D	Reboiler reaction. Dry boiling in oxygen passages.
4/2/64	California	Α	75T/D	В	Reboiler reaction. Hydrocarbon concentrated in single tube when dry boiling occurred. Erratic plant operation was only indication of reaction.
7/19/64	England	0	Tonnage	C or D	Reboiler reaction. Details unknown.
10/64	England	0	Tonnage	C or D	Reboiler reaction. Details unknown.
11/6/64	California	А	75T/D	В	Reboiler reaction. Undetermined contamination concentrated in single tube when dry boiling occurred. Loss of purity and H.P. column pressure, and increase of L.P. column pressure only indication of reaction.

Date of Accident	Location of Accident	Equip. Owned or Operated	Plant Size	Reboiler Type	<u>page 3 of 3</u> <u>Remarks</u>
1/65	Columbia	0	1.5T/D	Α	Condenser reaction destroyed plant. Details unknown.
3/29/65	England	A	200 T/ D	В	Reboiler reaction in a single tube at liquid level submergence line. Cause undetermined. Loss of purity was only indication of reaction.
2/7/66	Puerto Rico	0	2.5T/D	А	Reboiler tubes crushed, reboiler bulged, liquid level and oxygen drain ruptured. Cause undetermined.
11/20/66	Peru	0	.75T/D	F	Explosion in oxygen subcooler. Details unknown.
1/67	Illinois	0	Tonnage	?	Explosion in side arm column. Details unknown.
10/27/67	California	А	75T/D	В	Reboiler reaction. Contamination concentrated in tube when dry boiling occurred.
8/5/68	California	A	75T/D	В	Reboiler reaction. Contamination concentrated in tube when dry boiling occurred.
10/5/68	California	A	75T/D	В	Reboiler reaction. Contamination concentrated in tube when dry boiling occurred.
12/25/68	California	A	75 T /D	В	Reboiler reaction. Contamination concentrated in tube when dry boiling occurred.
3/24/70	Venezuela	0	5T/D	A	Plant exploded. Details unknown.
6/18/70	Jamaica	0	2.5T/D	A	Reboiler explosion believed caused by acetylene in reboiler.
6/9/71	Pennsylvania	0	Tonnage	C or D	Reboiler reaction. Faulty liquid level gauge which indicated 100% submergence instead of actual 85%. Cause dry boiling in the condenser.

^{0 -} Other Companies

A - Air Products and Chemicals, Inc.

A reaction within an oxygen compression system is usually of short duration although violent. The damage to the equipment is often severe. Usually, any evidence which can be useful in determining cause is destroyed in the reaction.

Date of Accident	Location of Accident	Equip. Owned or Operated	Type of Compressor	Remarks
-	Indiana	0	Centrifugal	Evidence of internal reaction found during normal maintenance.
	Illinois	0	Centrifugal	Oxygen compressor rotating backward without oil lubrication to bearings. Overheating ignited hot oil vapors.
Early '50	Europe	0	Reciprocating	Four reactions with fire origin in thin top section of 4th stage piston.
Late '50	South Africa	0	Centrifugal	No details.
1950	Europe	0	Centrifugal	Instabilities caused by operating too close to second critical speed.
2/27/58	Michigan	0	Reciprocating	No details.
1/15/59	Michigan	0	Centrifugal	Reaction in high pressure casing between the last stage wheel and balancing piston. No injuries reported. Cause undetermined.
5/59	England	0	Reciprocating	Grease left on valve springs after overhaul reacted with oxygen on compressor startup.
7/10/59	Louisiana	0	Centrifugal	Corrosion products caused by water leakage caused frictional heating and ignition in the balance piston area.
1960	Italy	0	Centrifugal	No details.
2/9/60	California	0	Reciprocating	Third stage oxygen compressor fire ruined the cylinder and blew off one of the valve covers. No injuries.
1960	Europe	0	Centrifugal	Instabilities caused by operating too close to second critical speed.

				Page 2 of 3
Date of Accident	Location of Accident	Equip. Owned or Operated	Type of Compressor	Remarks
Late '60	Luxembourg	0	Reciprocating	Bolt from cooler area dropped into piston-cylinder area and caused fire.
6/22/61	Michigan	0	Reciprocating	No details. Newspaper report indicates three (3) fatalities.
7/7/64	Louisiana	0	Centrifugal	Reaction believed caused by backflow of flammable fluids from anothr process.
1965	Germany	0	Reciprocating	Broken piston rod caused reaction.
1967	France	0	Reciprocating	Reaction caused by broken piston.
1967	India	0	Centrifugal	No details.
12/67	Poland	0	Centrifugal	Reaction occurred shortly after startup. Improper cleaning after long term storage believed to be cause.
1968	Germany	0	Centrifugal	Oxygen compressor rotating backward without oil lubrication to bearings. Overheating ignited hot oil vapors.
4/68	Scotland	0	Reciprocating	Water and corrosion material from leak in after cooler appears to be part of the cause of the reaction. Worker seriously injured.
6/17/68	Louisiana	6. 0 	Centrifugal	Particle appears to have entered compressor intake and caused case to impeller interference. No injuries.
6/28/68	Maryland	A	Centrifugal	High pressure case reaction may be associated with major electrical failure which occurred at the same time.
9/68	Holland	O () () () ()	Centrifugal	No details.
10/14/68	Louisiana	. 0 g ()	Centrifugal	A fatality occurred when the rebuilt oxygen compressor of June 1968 accident failed upon initial startup.
12/14/68	West Virginia	A	Centrifugal	A routine internal inspection revealed that a reaction occurred at some previous startup without involving the compressor. A labyrinth seal was installed backward.

OXYGEN COMPRESSOR ACCIDENTS

V=2 (continued) Table VD2 Page 3 of 3

Date of Accident	Location of Accident	Equip. Owned or Operated	Type of Compressor	Remarks
12/27/68	Pennsylvania	0	Centrifugal	Improper cleaning in discharge volute believed cause of fire in discharge of compressor.
3/18/69	Ohio	A	Centrifugal	Low pressure case burn through. Mechanical failure in thrust bearing area caused shaft to shift. Fire started in fourth stage and burned through into second stage.
4/4/69	Illinois	. 0	Centrifugal	Reaction occurred on startup of compressor.
4/15/69	Pennsylvania	0	Centrifugal	Origin of fire appears to be in the seventh stage of the high pressure case. No injuries reported. Details concerning cause are lacking.
6/69	Germany	0	Centrifugal	Dirty intercoolers believed to be cause.
12/5/69	California	А	Centrifugal	High and intermediate pressure case of compressor burned through causing one (1) fatality and injury to eight (8) others.
1969	Japan	0	Centrifugal	No details.

^{0 -} Other Companies

A - Air Products and Chemicals, Inc.

The cause of many LOX pump accidents has been established only with difficulty as most of the evidence needed to determine cause has been destroyed in the reaction.

Date of Accident	Location of Accident	Equip. Owned or Operated	Type of Pump	Trailer of Plant Mounted	Remarks
3/19/57	Canada	0	Centrifugal	Plant	Pump seized resulting in fire.
8/13/57	Ohio	0	-	Trailer	Pump exploded during transfer of LOX. No details.
1/22/60	California	А	Reciprocating	Trailer	Fire occurred while pump under test. Plunger rod material of questionable compatibility. One (1) fatality, two (2) injured.
2/11/60	Pennsylvania	Α	Reciprocating	Plant	Involved only the mechanical failure of pump barrel. No combustion reaction involved.
12/60	_ '	0	Reciprocating	Plant	Pump explosion due to peeling of chrome plating on pump rod and subsequent ignition.
8/28/61	Illinois	0	Centrifugal	Trailer	Tanker fire and explosion believed to have occurred during transfer of LOX to plant storage. Reported in AIChE, Safety in Air and Ammonia Plants, Volume 4, page 49 (Doc. #99000299).
2/1/62	Pennsylvania	A	Centrifugal	Plant	Hydrocarbon accumulation in multi-stage pump. Reaction is discussed in AIChE, Safety in Air and Ammonia Plants, Volume 5, page 41 (Doc. #99000300).
11/12/62	Pennsylvania	A	Reciprocating	Plant	Oil contaminated interconnecting. Tubing was also pressure underrated. Reaction caused injury to to three (3) persons.
3/6/63	Pennsylvania	0	Centrifugal	Plant	Oil contamination in LOX lines and pump ignited upon starting a warm pump. One (1) fatality and three (3) injured. Plant equipment severely damaged in air of reaction. Reported in AIChE, Safety in Air and Ammonia Plants, Volume 6, page 41 (Doc. #99000261A).

LIQUID OXYGEN PUMP ACCIDENTS

V-2 (continued) Table VD3 Page 2 of 4

					Page 2 of 4
Date of Accident	Location of Accident	Equip. Owned or Operated	Type of Pump	Trailer of Plant Mounted	Remarks
10/11/63	Sweden	0	Reciprocating	Plant	Substitution of pump rod material and application of chrome plating to rod caused peeling of plating material which reacted with oxygen to cause fire.
10/24/63	Sweden	0	Reciprocating	Plant	Substitution of pump rod material and application of chrome plating to rod caused peeling of plating material which reacted with oxygen to cause fire.
12/4/63	Maryland	Α	Reciprocating	Plant	Mechanical failure of connecting rod due to excessive tightening of pump packing.
12/16/63	England	A	Centrifugal	Trailer	Believe bearing failure caused interference between pump impeler and case with subsequent ignition. One (1) person slightly injured.
5/21/66	Ohio	0	Centrifugal	Plant	Fire in LOX pump caused by thrust bearing failure attributed to water in lubricant. One (1) person injured. Reported in AIChE, Safety in Air and Ammonia Plants, Volume 9, page 5 (Doc. #99000301).
5/23/66	Ohio	0	Centrifugal	Plant	Believe foreign object entered pump and initiated reaction. Pump was replacement for 5/21/66 pump accident. No injuries. Reported in AIChE, Safety in Air and Ammonia Plants, Volume 9, page 5 (Doc. #99000301).
9/2/66	England	0	Centrifugal	Trailer	LOX tanker exploded when submerged LOX pump failed Two (2) people killed and seventeen (17) injured.
10/6/66	Louisiana	0	Centrifugal	Trailer	LOX pump fire during transfer of product to storage.
11/3/66	Germany	0	-	Trailer	Fire started during transfer of LOX from trailer to storage.

LIQUID OXYGEN PUMP ACCIDENTS

Date of Accident	Location of Accident	Equip. Owned or Operated	Type of Pump	Trailer o	
12/21/66	Florida	0	Centrifugal	Trailer	Believe foreign object entered pump and initiated reaction.
10/13/67	Pennsylvania	0	Reciprocating	Plant	Fire in pump originating in area of insulating seal and seal nut believed caused by tight pump packing.
2/26/68	Louisiana	A	Centrifugal	Plant	Oxygen from pump packing entered lower motor bearing case where reaction occurred damaging motor.
3/3/68	England	A	Centrifugal	Trailer	Bearing wear caused interference between pump impeller and case.
12/68	Pennsylvania	0	Centrifugal	Plant	Foreign material entered pump and impacted impeller.
12/68	Pennsylvania	0	Centrifugal	Plant	Bearing failure occurred. Pump was stopped before damage to pump internals. No fire occurred.
1/22/69	Germany	0	-	Trailer	Tanker under test when control end caught fire. No other details.
2/26/69	Belgium	A	Centrifugal	Plant	Poor lubrication permitted bearing wear which eventually caused interference between pump impeller and case and subsequent fire. No injuries.
9/69	Delaware	A	Centrifugal	Trailer	Fire in pump restricted to bearing case. Bearing and pump seal failure. No injuries.
10/69	Delaware	Α	Centrifugal	Trailer	Fire in pump restricted to bearing case. Bearing and pump seal failure. No injuries.
12/14/69	Pennsylvania	Α	Centrifugal	Trailer	Bearing wear caused interference between pump impeller and case.

LIQUID OXYGEN PUMP ACCIDENTS

V-2 (continued) Table VD3 Page 4 of 4

					Page 4 of 4
Date of Accident	Location of Accident	Equip. Owned or Operated	Type of Pump	Trailer of Plant Mounted	Remarks
1/70	England	А	Centrifugal	Trailer	Bearing wear caused interference between pump impeller and case.
5/70	France	A	Centrifugal	Trailer	Bearing wear caused interference between pump impeller and case. Two (2) persons injured in fire.
6/3/70	England	A	Centrifugal	Plant	Bearing wear caused interference between pump impeller and case with subsequent ignition. No injuries.
8/7/70	England	A	Centrifugal	Plant	Parts of pump inlet filter is believed to have entered pump and caused interference between impeller and case with subsequent ignition.
8/17/70	Pennsylvania	0	Centrifugal	Plant	Cause appears to be bearing failure which permitted pump parts interference with subsequent ignition. No injuries.
9/8/70	Puerto Rico	A	Centrifugal	Plant	Pump failure caused by sequence of lubrication failure, bearing failure, rubbing contact, and ignition. No injuries reported.
2/17/71	England	A	Centrifugal	Trailer	Contamination in pump under test believed to be cause of reaction. One (1) fatality and two (2) injured.
3/5/71	England	A	Reciprocating	Plant	Mechanical failure of internal pump parts supplied the source necessary to ignite the pump materials of construction.

^{0 -} Other Companies

A - Air Products and Chemicals, Inc.

Reactions which occur in oxygen regulators usually result in complete destruction of the regulator. The reaction usually occurs when the operator is operating his supply valves or adjusting the regulator resulting in injury, usually serious, to the operator. The exposure is initially to thermal burns by hot metal, followed by exposure to oxygen

which supports the combustion vigorously. The table lists the area of

the regulator involved and the apparent cause of the reaction.

Date of

Location of

Accident	Accident	Remarks	
5/15/67	Texas	No details.	
7/14/58	New York	No details.	
8/22/58	New York	No details.	
1958	New Jersey	Repairs by others.	
7/59	New York	No details.	
6/20/60	Indiana	H.P. side reaction. Repairs by others.	
9/22/60	New Jersey	H.P. side reaction. Cause not determined. Regulator attached to tube trailer. Moderate damage to customer property.	
12/9/60	. West Virginia	H.P. side reaction. Cause unknown.	
9/4/61	Ohio	L.P. side reaction. Cause unknown.	
4/24/62	Pennsylvania	Involved in fire but not cause of reaction. Incorrect operating procedures.	
6/22/62	Arkansas	H.P. side reaction. Source of fuel from portable acetylene generator believed to contributory.) be
6/22/62	Ohio	No details. Oxygen-acetylene outfit in fire.	
5/20/63	Maryland	H.P. side reaction. Operating procedure believed to be cause.	
11/21/62	New Jersey	L.P. side reaction. Operating procedure believed to be cause.	

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OXYGEN REGULATOR ACCIDENTS

			CA STORT
Date of Accident	Location of Accident	Remarks	Page 2 o
8/26/63	Pennsylvania	H.P. side reaction. Dirt in	in an uncleaned part of system was cause of reaction.
1/27/64	Maryland	Hydrogen in oxygen system reacted.	cted. System design was cause.
5/13/64	Pennsylvania	L.P. side reaction. Operating	Operating procedure was cause.
5/22/64	Pennsylvania	Improper equipment maintenance	e was cause.
5/25/64	Pennsylvania	L.P. side reaction. Operating	g procedure was cause.
1/14/64	Michigan	L.P. side reaction. Equipment	Equipment in poor repair.
10/31/64	Maryland	3 regulators involved. Hydrog	Hydrogen in oxygen system. System design was cause.
1/65	Oklahoma	Defective regulator was tested procedure incorrect.	tested with oxygen to determine repairs required. Operator
8/30/65	Virginia	No details.	
59/6	Virginia	No details.	
1/1/66	Georgia	L.P. side reaction. Operating	Operating procedure was cause.
3/13/66	Pennsylvania	L.P. side reaction. Operating	g procedure was cause.
8/27/66	Illinois	H.P. side reaction. Operating	Operating procedure appears to be cause.
3/15/67	Virginia	H.P. side reaction. Contamina	Contamination introduced to regulator during repairs.
5/10/67	Alabama	H.P. side reaction. Contamina	Contamination introduced during repairs.
5/24/67	Pennsylvania	L.P. side reaction. Operating	Operating procedure appears to be cause.
7/25/67	New York	H.P. side reaction. Improper repairs	repairs may be cause.
10/21/68	Ohio	Reaction appears to have initiated	ated in H.P. gauge bourdon tube. Cause undetermined.

OXYGEN REGULATOR ACCIDENTS

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Table	<i>i</i> e	ID4			
Page	3	of	3		

Date of Accident	Location of Accident	Remarks
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4/69	Maryland	L.P. side reaction. No details.
5/69	Maryland	L.P. side reaction. No details. Same regulator as April 1969.
5/29/69	Maryland	H.P. side reaction. Origin of reaction outside of regulator in cylinder valve or valve passages and involved the regulator.
11/69	Michigan	A series of L.P. side reactions caused by improper design of fuel system for cold weather operation.
11/69	Missouri	A series of L.P. side reactions n of fuel system for cold weather operation.
1/30/69	Alabama	H.P. side reaction. Contamination introduced through local repair.
10/17/69	Pennsylvania	H.P. side reaction. Origin of this reaction is the oxygen cylinder valve seat.
1/8/70	New Jersey	H.P. side reaction. Cause undetermined.
5/1/70	California	Jetcut machine extensively damaged by back-fire of oxy-fuel mixture caused by incorrect tips and damaged seating surfaces.
5/7/70	Tennessee	H.P. side reaction. Origin of reaction appears to be oxygen cylinder valve seat.
6/23/70	Arkansas	H.P. side reaction. Insufficient details, however, work are contaminated heavily with oil and grease.
11/23/70	Virginia (1)	Poor practice of changing regulator from one product service to oxygen service without complete disassembly and solvent wash.
3/5/71	North Carolina	H.P. side reaction. Origin of reaction is external to regulator.
6/22/71	Michigan	Jetcut machine involved in fire which originated in electrical system. One torch was also defective.

PIPING AND LINE ACCIDENTS

	ACCIDENTS	V-2 (continued)
		Table VD5
		Page 1 of 2

AND COLUMN	Date of	Location	Equip. Owner	rage I of z
***************************************	Accident	of Accident	or Operator	Remarks
QUILDON CONTRACTOR CON	10/28/58	California	APCI	Leak in transfer hose connection between tanker and storage permitted LOX to penetrate asphalt paving. Explosion occurred when driver jumped from tanker to paving seriously injuring the driver and helper.
VVV4V444444444444444444444444444444444	12/4/58	California	Other	Fire burned through valve and piping system connected to six (6) high pressure tubes, four (4) of which became projectiles upon release of residual pressure. Evidence of noncompatible materials in the system with an ignition source associated with friction, velocity, and adiabatic compression when a closed valve was opened. No injuries, but serious property damage.
	1/9/60	Connecticut	APCI	Rubber high pressure hose ruptured and ignited during transfer of gaseous oxygen from tube trailer to storage system. Material not compatible in oxygen service. Driver was seriously injured.
	8/29/61	Ohio	APCI	High pressure stainless steel piping ignited and burned. Oil and carbon steel rod were found in system. Sabotage suspected. No injuries.
	7/16/62	Ohio	Other	Regulator station and associated piping feeding oxygen to steel mill furnace seriously damaged when reaction occurred within a system shut-off valve. Compatibility of material in one valve is suspected. An excess flow valve closed off the supply of oxygen to the fire to limit the area of fire involvement.
	7/19/62	Kansas	Other	Underground drain system exploded after excess LOX from storage entered drain. Dirt in drain and drain pipe embrittlement.
	4/3/63	Tennessee	APCI	High pressure oxygen line ruptured due to reaction of small amount of fuel and incorrect pressure rating of pipe material.
	6/12/64	Illinois	APCI	High pressure oxygen flexible transfer line failed at fitting. Field repairs were made incorrectly.
	6/64	Minnesota	Other	Failure of piping and manifold system for high pressure oxygen. System fabricated of low pressure pipe, noncompatible material, and valve stems lubricated with hydrocarbon oil. One person seriously injured.

Remarks

oxygen. Incorrect material for the service.

to residual fuel gas in one of cylinders being processed.

to residual fuel gas in one of cylinders being processed.

New carbon steel shop line solvent washed and dried with oil laden shop

Reaction in high pressure oxygen manifold and piping system possibly due

Reaction in high pressure oxygen manifold and piping system possibly due

air. Reaction occurred when oxygen flow was stopped after first use

Equip. Owner

or Operator

Other

Other

Other

Date of

Accident

11/12/64

1/21/69

4/70

Location of Accident

West Virginia

West Virginia

Ohio

9/26/65	West Virginia	Other	Fire in suction line to an oxygen compressor occurred when the suction shutoff valve chain operator failed causing the valve to lock partially open. Change of velocity of the gas through the valve is suspected of being ignition source for the valve material. One man fatally injured.
4/29/66	Louisiana	APCI	Damaged and cracked insulation on a liquid hydrogen piping system permitted air to be liquefied against the cold pipe surfaces. Some distillation caused oxygen enrichment of the liquid air which accumulated in the insulation. It is believed some hydrogen leak in the piping system reacted with the oxygen rich air causing damage to the insulation and line. Ignition source is unknown. No injuries reported.
1966	Pennsylvania	Other	Embrittlement failure of 400' of carbon steel line due to excessive draw of LOX from storage and vaporizer system. Temperature control valve on outlet side of vaporizer did not respond quickly enough.
7/12/68	Ohio	Other	Buna "N" seat of ball valve ignited during blowout of new line with

of line.

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STORAGE SYSTEM ACCIDENTS

V-2 (C	onti	inı	ued.	
Table	۱ ج	VD6			
Page	1	of	1		

Date of Accident	Location of Accident	Equip. Owner or Operator	Remarks Page 1 of 1
8/25/64	California	APCI	A check valve installed in the piping of a LOX storage tank lost its bonnet due to improper assembly or working loose during flow conditions. Thirty-four thousand (34,000) gallons of LOX spilled before corrective measures could be taken. Water was effectively used to vaporize the LOX without a reaction occurring.
8/19/66	Florida	Other	Eight hundred thousand (800,000) gallons LOX spilled when flex line segment of pump suction line failed. A large area was affected by the spill including a macadam road. Water effectively vaporized the LOX without incident.
11/26/66	California	APCI	A new 190,000 gallon LOX tank developed a leak in the inner tank during initial filling operations. The leak developed when the tank was about 1/3 full. Product was transferred to tankers and moved to other storage areas without incident or without the loss of any significant amounts of LOX.
5/13/68	Pennsylvania	Other	A weld joint in the LOX fill-drain line of a large storage tank failed. The location of the line in the space between the inner and outer vessels exposed the outer carbon steel vessels to cold product. When failure of the outer shell occurred, approximately 215,000 gallons of LOX spilled into the area. Water was used to vaporize the spilled product without incident. (Ball, W. L., LOX Spill, APCI Doc. #99000220).
2/24/71	Pennsylvania	APCI	A 6,000 gallon tank toppled during filling with LOX when a concrete pad failed. Surface water seeped through a small crack in the pad and eroded the ground beneath the pad. The tank sustained light damage as did the vehicle against which the tank came to rest after toppling. No fire or injuries.

V-2 (continued)	Table VD7	L & C L 0 = 0 C

GAUGES AND INSTRUMENTATION ACCIDENTS

Page 1 of	Remarks	The product from a LOX tanker was being transferred into storage. A meter onnected in this line was not propertly cooled-down when the flow started. The resulting vaporization of LOX caused the meter to overspeed with resulting increase in temperature and ignition of materials. The ensuing fire, supplied by LOX from the trailer, involved two (2) tankers, a 30,000 gallon LOX tank, another vehicle, and support equipment.	A gaseous oxygen flow meter used to measure vaporization from a storage tank was exposed to liquid oxygen temperatures when the storage tank was overfilled. The meter ruptured from metal embrittlement and overpressurization, caused by the vaporizing LOX. No injuries involved. Shrapnel damage existed in the immediate area.	Oxygen test gauge exploded during cylinder testing operation. Using same gauge in several services may have contaminated it. Slight injuries. Safety glasses saved the operator's eyes.	Oxygen test gauge exploded during cylinder testing operation. Using same gauge in several services may have contaminated it. Slight injuries. Safety glasses saved the operator's eyes.	Oxygen manifold gauge fire and explosion. Hydrocarbon oil used in dead weight tester contaminated gauge which was in daily service for six (6) months prior to accident. Position of gauge above line of sight prevented injury.	Oxygen test gauge failure due to contamination from use in different product service or from cylinder valve seat failure. One man blinded.	The operator failed to read the gauge face label which stated "Do not use in Oxygen Service" because the gauge was dead weight tested with hydrocarbon oil. The gauge exploded when placed in an oxygen cylinder for a pressure check. Safety glasses saved the operator's eyes.	Test gauge failure due to contamination from use in different product service. A rubber connecting pigtail hose may have also been the source of contamination which contributed towards the reaction.
Equip. Owner	or Operator	Other	APCI	APCI	APCI	APCI	APCI	APCI	APCI
Location of		Florida	Pennsylvania	Illinois	Tennessee	Pennsylvania	Missouri	lowa	Minnesota
Date of	Accident	11/26/58	4/15/59	5/23/61	2/4/64	3/23/64	2/6/67	6/29/67	6/12/68

LIQUID AND GASEOUS OXYGEN SAFETY REVIEW DATA

V. Accident/Incident Investigation and Report

The following is a series of APL Safety Bulletins and APL Safety Department Reports related to accidents involving oxygen:

- (1) APL, Fire in Oxygen Line, APL Safety Bulletin No. 28, Reprinted January 1968 (Doc. #99000382).
- (2) Everson, I., Accident at an Oxygen Charging Manifold, APL Safety Bulletin No. 46, (Doc. #99000383).
- (3) Everson, I., Accident Arising from Vented Oxygen Manifolds Connected to a Common Vent Pipe, APL Safety Bulletin No. 75, December 11, 1969, (Doc. #99000384).
- (4) Everson, I., More Accidents on Oxygen Equipment, APL Safety Bulletin No. 102, February 8, 1971, (Doc. #99000385).
- (5) Everson, I., and J. S. Lanba, Burckhardt Oxygen Compressor Fire at SSPC Rognac Plant 3/2/71 (Abstracted from Report JSL/NB 1293 by J. S. Lanba), APL Safety Bulletin No. 107, April 14, 1971, (Doc. #99000386).
- (6) Gillott, E., and I. Everson, Failure of Brazed Joints in High Pressure Gaseous Oxygen Line at a Cylinder Filling Depot, APL Safety Bulletin No. 114, July 13, 1971, (Doc. #99000387).
- (7) Everson, I., and P. Cook, Preliminary Report on Accident at Zelzate Plant 26th February 1969 When an Explosion and Fire Occurred in Burckhardt Centrifugal LOX Pump, Type GBl14, No. 29224, APL Safety Department Report No. 16, February 28, 1969, (Doc. #99000388).
- (8) Croxford, B. J., I. Everson, and R. Naylor, Report on Explosion of LOX Pump on Tanker 400-11, 7th January, 1970 at John Summers' Steel Works, Shotton. Pump Type GBll4, Serial No. 79, APL Safety Department Report No. 26 (Preliminary), January 15, 1970, (Doc. #99000389).
- (9) Everson, I., Accident at T. Turner Ltd., Park Lane, Royton, Oldham, Lancs., 11:40 a.m., Saturday, 2nd May 1970, APL Safety Department Report No. 30 (Preliminary), May 5, 1970, (Doc. #99000390).



- (10) Everson, I., Investigation of Valve Fires at Texas Instruments Ltd., Bedford, APL Safety Department Report No. 31, Rev. 1, February 11, 1971, (Doc. #99000391).
- (11) Everson, I., Explosion and Fire Due to the Cryostar GB114 LOX Pump on an SSPC LOX Tanker, APL Safety Department Report No. 32, July 10, 1970, (Doc. #99000392).
- (12) Everson, I., Investigation of Cryostar LOX Pump Explosion at Stoke Plant: 7th August, 1970, APL Safety Department Report No. 34 (Preliminary), August 24, 1970, (Doc. #99000393).
- (13) Coulson, K. J., B. J. Croxford, and I. Everson, Report on Explosion of Cryostar GB.114 Pump No. C.75 on Tanker 400-11 17th February 1961 at the Carrington Plant, APL Safety Department Report No. 35, March 5, 1971, (Doc. #99000394).
- (14) Ball, W. L., B. Berrettini, I. Everson, and D. K. Griffiths, Recommendations Arising from Explosion of Cryostar GB.114 Pump No. C75 at Carrington 17th February 1961 as Reported in Safety Department Report No. 35, APL Safety Department Report No. 36, March 10, 1971 (Doc. #99000395).
- (15) Boynton, M. C. W., G. I. Brown, N. Shepherd, and I. Everson, Explosion on Oxy-Fuel Burner Equipment at Alcan-Booth Aluminum Works, Rogerstone, Newport, Mon. 18th May 1971, APL Safety Department Report No. 37, June 2, 1971, (Doc. #99000396).
- (16) Moore, A. A., Report on Service Visit to H. M. S. Eagle, APL Reference X0425, August 18, 1971, (Doc. #99000302).
- (17) APL, Experiments with Liquid Oxygen, APL Safety Bulletin No. 25, Reprinted January 1968 (Doc. #99000419).
- (18) APL, Lack of Oxygen Kills Two Workmen, APL Safety Bulletin No. 37, Reprinted January 1968 (Doc. #99000420).
- (19) Zurawski, J., Report of Investigation Into Burckhardt Centrifugal Pump Explosion and Tanker Fire at Sheepbridge Alloy Castings Ltd. Sutton in Ashfield, Notts., February 5, 1964 (Doc. #99000421).

LIQUID AND GASEOUS OXYGEN SAFETY REVIEW DATA

V. Accident/Incident Investigation and Report

The following is a series of APCI Documents covering safety precautions, accidents, and near misses involving oxygen or air separation plants:

- (1) Kitson, F. K., Don't Turn a Cylinder Into a Rocket, APCI Safety Gram No. 4C, August 7, 1961 (Doc. #99000001).
- (2) Kitson, F. K., Fire in Oxygen Line, APCI Safety Gram No. 5, October 20, 1961 (Doc. #99000002).
- (3) Kitson, F. K., Liquid Oxygen Loading, APCI Safety Gram No. 6, November 17, 1961 (Doc. #99000003).
- (4) Kitson, F. K., Approved Alloy Steels in Cryogenic Service, APCI Safety Gram No. 10, Revision 1, October 25, 1963 (Doc. #99000004).
- (5) Schmoyer, W. W., Oxygen Cylinder Failure, APCI Safety Gram No. 13, June 1, 1962 (Doc. #99000005).
- (6) Kitson, F. K., Isolation of Piping Systems, APCI Safety Gram No. 21, October 29, 1962 (Doc. #99000006).
- (7) Schmoyer, W. W., Drain Line Explosion, APCI Safety Gram No. 24, January 17, 1963 (Doc. #99000008).
- (8) Schmoyer, W. W., Sniff Those Cylinders Before Refilling, APCI Safety Gram No. 31, August 21, 1963 (Doc. #99000010).
- (9) Schmoyer, W. W., Vacuum Pump Failures, APCI Safety Gram No. 35, October 4, 1963 (Doc. #99000011).
- (10) Schmoyer, W. W., Pressure Gauge Failures, APCI Safety Gram No. 43, May 8, 1964 (Doc. #99000012).
- (11) Schmoyer W. W., Human Torches, APCI Safety Gram No. 50C, January 3, 1966 (Doc. #99000013).
- (12) Schmoyer, W. W., Oxygen Regulators in the Welding Industry, APCI Safety Gram No. 60C, November 26, 1967 (Doc. #99000014).
- (13) APCI, Instrumentation -- Establishing Pressure Settings of Safety Devices, APCI Design Engineering Standard 537.1, April 21, 1959 (Doc. #99000023).
- (14) Schmoyer, W. W., Caution-Sniff Testing Cyliders Has Its Hazards, APCI Safety Gram No. 49, March 26, 1965 (Doc. #99000056).



- (15) Walde, R. A., Flammability and Explosion Hazards -- Halocarbon, Molylube 99, Molykote Types Z and X-15, Calosil M-5 Formica Laminate Bonded with a Phenolic Resin, Cutting Oils, Hexadecane, Hydrocarbon Type Cutting Oils, Known as Type Group II, Plant Wash-Out Studies Cellulube 300, Cellulube 220, APCI MAR 87-0-8821, June 1963 (Doc. #99000073).
- (16) Walde, R. A., Flammability and Explosion Hazards -- Plant Wash-Out Studies Cellulube 300, DTE 103, Cellulube 200, Recent Fires at DuPont New Johnsonville Plant, Titanium, Titanium Dioxide, Solnus 500, Hydrocarbon Oil, Titanium Tetrachloride, APCI MAR 87-0-8822, August 1963 (Doc. #99000074).
- (17) Walde, R. A., Flammability and Explosion Hazards -- Plant Wash-Out Study Cellulube 300, DTE 103, Recent Fires at DuPont New Johnsonville Plant, Solnus 500, Titanium Tetrachloride, APCI MAR 87-0-8822, August 1963 (Doc. #99000075).
- (18) Walde, R. A., Flammability and Explosion Hazards -- Plant Wash-Out Studies Cellulube 300, Cellulube 220, APCI MAR 87-0-8822, July 1963 (Doc. #99000076).
- (19) APCI, Instrumentation -- Modification to Existing Pressure Gauges Snubber, APCI Design Engineering Standard 531.10.2, December 5, 1961 (Doc. #99000282).
- (20) APCI, Safe Handling of Cryogenic Liquids and Associated Equipment, APCI Plant Operations Manual Section 1.17, April 23, 1969 (Doc. #99000283).

NUMERICAL SECTION

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10/25/63
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YER, W.W. APCI VACUUM PUMP FAILURES APCI-SAFETY-GRAM-ND-35 1P 10/4/63
YER, W.W. APCI VACUUM PUMP FAILURES APCI-SAFETY-GRAM-ND-43 2P 5/8/64
YER, W.W. APCI PRESSURE GAUGE FAILURES APCI-SAFETY-GRAM-ND-50C 1P 1/3/66
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YER, W.W. APCI UXYGEN REGULATORS IN THE WELDING INDUSTRY APCI-SAFETY-GRAM-ND-60C 5P 11/26/67
PRESSURE-VESSELS- VAPORIZER AND CRYGGENIC LIQUID DISPOSAL APCI-DES-ENG-STD-514.3 3P 10/17/60
PRESSURE-VESSELS- GASEGUS UXYGEN STORAGE CYLINDER APCI-DES-ENG-STD-515.1.3 3P 10/17/60
PRESSURE-VESSELS- WASSELS- MAPERIALS OF CONSTRUCTION APCI-DES-ENG-STD-510.1.4 4P 6/62
PRESSURE-VESSELS- MATERIALS OF CONSTRUCTION APCI-DES-ENG-STD-510.1.4 4P 6/62
PRESSURE-VESSELS- HEAD-DESIGN APCI-DES-ENG-STD-510.1.4 4P 6/62
PRESSURE-VESSELS- HEAD-DESIGN APCI-DES-ENG-STD-510.1.4 4P 6/62
PRESSURE-VESSELS- HEAD-DESIGN APCI-DES-ENG-STD-510.2 5P 10/63
INSTRUMENTATION- PRESSURE INDICATORS APCI-DES-ENG-STD-531.2 5P 10/63
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MASTER, E.J. APCI CLEANING FOR OXYGEN SERVICE 17P 1/60
MASTER, H.H. APCI CLEANING FOR OXYGEN SERVICE 17P 1/60
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APCI CLEANING APCI-CONSTR-SPEC-230.15 GN P8 1P 9/16/69
APCI CLEANING GF CARBON STEEL PIPE AND FIRTINGS, CLEANING ALUMINUM-PIPE FITTINGS PARTS AND FABRICATIONS OF CLEANING-MEDIUMS, CLEANING STAINLESS-STEEL AND CUPPER-PIPE FITTINGS PARTS AND FABRICATIONS DESCRIPTION OF DECONTAMINATED COMPONENTS, AND PICKLING GF CARBON-STEEL PIPE AND FITTINGS APCI-CONSTR-SPECTS OF RECENSTRUCTED ICI TCNNAGE OX YGEN PLANT AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS V-5 PI-15 15P 1963
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HIMMELBERGER,F. APCI NOTES ON LIQUID OXYGEN CONTAMINANTS MISSILE-PROGRAM 10P 1/6/58
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NINAN,E. APCI GSSEMBLY OF UXYGEN REGULATORS FOR VARIOUS MATERIALS—88MA THREAD LUBRICANT AND SEALANT, ANDE
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YOUER, L. APCI TAPE-SEAL THREAD LUBRICANT AND SEALER— TAPE-SEAL FROM FRIESLAND-PLASTIC COMPANY, PERMACE
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    WALDE "R. A. APCI GASEGUS GXYGEN COMPATIBILITY OF CROSSLITE FLUGROCARBON TAPE THREE-M-FLUGROCARBON-TAPE,
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1**A**L** APCI STORAGE TANK CLEANING APCI—MEMG—63 1P APCI—MEMG—64 03/11/64 1P P
                                               2P PLUS
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APCI-QUAL-CONT-LAYOUT-106F 3P 7/1/71
APCI-GUAL-CONT-LAYOUT-107F 3P 7/1/71
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                                                                                                                                                                                                    APCI-GUAL-CONT-LAYOUT-104F
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                                     APCI CLEANING REQUIREMENTS FOR AIR-PLANT EQUIPMENT
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CLASS-AAA CLEANLINESS REQUIREMENTS
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CLASS-A CLEANLINESS REGUIREMENTS
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HEATLEY,C.J. DINAN,E.R. APCI INVESTIGATION OF THE FIRE-RESISTANT QUALITIES OF CELLULUBE-220, CELLULUBE-15, HEATLEY,C.J. DINAN,E.R. APCI INVESTIGATION OF THE FIRE-RESISTANT QUALITIES OF CELLULUBE-FS, FLUOROLUBE-FS, KELF-LF3, VERSILUBE-F-50, SFB1(40)-SILICONE, PYDRAUL-F-9, DOW-CORNING-4 COMPOUND SILICONE, DOW-CORNING-4X COMPOUND-SILICONE, FAIRBANKS-SILICONE-DC-44, MURSE GREASE, ALPHA-CORP-MOLYKOTE-MICROSIZE, MONSANTO-PYDRAUL, GULF-MCHANISM-HYDROCARBON, HAVOLINE-HO-HYDROCARBON, SHELL-Z-1176-A-HYDROCARBON, INDGIL CHEMICAL INDUPOL-1-10-POLYBOTE MANANTO-PYDRAUL, GULF-DT-10-POLYBOTE MANANTO-PYDRAUL, GULFATH MANANTO-PYDRAUL, GULFATH MANANTO-PYDRAUL, GULFATH MANANTO-PYDRAUL, GULFATH MANANTO-PYDRAUL, GULFATH MANANTO-PYDRAUL, GUNFATIALLITY UF MELRATH MARCALAMANDAR APCI-IMO-NO-EA-7027 2P 1/30/70 LATSHAW,D.R. APCI GASKET MATERIALS COMPATBILITY UF GASKET MATERIALS WITH UXYGEN COMBUSTION IN OXYGEN AND SOXHLET ETHER-EXTRACTION GARLOCK-900, KM-226, KM-246 APCI-ANAL-REP-70-013,70-014,70-015 APCI-123 A NASA-HCUSTON NONMETALLIC MATERIALS DESIGN GUIDELINES AND TEST DATA-HANDBOOK MSC-02681 380P 5/29/70
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LAPIN,4. APCI TESTING UF SCREENS TO BE USED IN GXYGEN COMPRESSOR SUCTION APCI-MEMO-71 07/26/71 2P
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FREDERICK; A APCI MASTER DRAWING-SERIES REGULATIONS APCI-DRAWING-OOD-G-407004E IP 3/4/68
FREDERICK; G. LATSHAW; D.R. APCI COMPATIBILITY OF MATERIAL WITH CXYGEN JOHNS-MANVILLE ASBESTOS SHEET
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KGBINSON; G.W. APCI LOX COMPATIBLE GASKET MATERIALS GARLGCK-900 DUKABLA JOHNS-MANVILLE ASBESTOS SHEET
FREDERICK; G. LATSHAW; D.R. APCI FLUCKESCENCE OF VARIOUS TYPES OF GILS-MOBIL-DTE-105 TEXACU-CAPPELLA-A
CELLULUBE-550 FLUCROLUBE SEARS-THREAD-CUTTING-OIL APCI-ANAL-REP IP 7/15/71
FREDERICK; L.G. LATSHAW; D.R. APCI CXYGEN COMPATABILITY WITH TWO-PART EPOXY-COMPOUND (7343-RESIN-7139
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                                                                                                                                                              APC I-BROC
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              AMMONIA
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AIR-FRACTIONATION PLANT EXPLOSION AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AM
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                                                                                      4P 1/30/70
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AFETY IN AIR AND AMMONIA PLANTS V-2 PP31-36 1960
ROIZLER, R.W. ET.AL GXYGEN PLANT REBOILER EXPLOSION AICHE-CEP-TECH-MANUAL SAIPLANTS V-2 PP31-36 1960
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BALL, W.L. APCI GISCUSSION OF ENERGY RELEASE IN A LIQUID GXYGEN PUMP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   MANUFACTURED LOX TANKERS BY AMETEK
      ANALYT ICAL
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BYRON-JACKSON DXYGEN PUMP WASHOUT PROCEDURE FOR
                                                                        PRODUCT TEST PROCEDURES 1200-SERIES REGULATORS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     LANG, A. LINDE AIR-FRACTIONATION PLANT EXPLOSION ANTS V-4 PP71-80 1962
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TS V-9 P5 1967
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OFFICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPLLINE—MINIMUM FEDERAL SAFETY—STANDARDS ESTABLISHMENT OF MINIMUM STANDARDS FEDERAL REGISTLR VOL—35 NO—161 8/19/70
OFFICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE—MINIMUM FEDERAL SAFETY—STANDARDS FILING OF INSPECTION AND MAINTENANCE PLANS FEDERAL REGISTER VOL—35 NO—205 10/31/70
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APCI PERSUNNEL-PROTECTIVE-EQUIPMENT- OCCUPATIONAL NOISE PROTECTIV

ASTER,H.H. APCI OPERATIONS HEARING PROTECTION PROGRAM APCI-MEMO-71 04/7/71 2P PLUS IP Altachment

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APCI OPERATIONS SAFETY MANUAL APCI-SAFETY MANUAL-ZOP64 88P 1964 (OUT OF PRINT)
APCI MAINTENANCE OF PORTABLE FIRE-EXTINGUISHERS APCI-POM-SEC-1.13 5P 3/30/67
HUBBS,M.H. APCI FIRE PROTECTION CGA AIR-SEPARATION PLANT SAFETY SYMPOSIUM PP175-184 10P 10/63
APCI PERSONNEL-PROTECTIVE-EQUIPMENT ALUMINIZED HEAT PROTECTIVE CLOTHING APCI-SAFETY-STD-627.4.7 2P AMERICAN SOCIETY OF MECHANICAL ENGINEERS PETROLEUM REFINERY PIPING ANSI-831.3 104P 1966 AMERICAN SOCIETY OF MECHANICAL ENGINEERS REFRIGERATION PIPING ANSI-831.5 60P 1966 THIELSCH#H. GRINNELL CO DEFECTS AND FAILURES IN PRESSURE—VESSELS AND PIPING REINHOLD PUBLISHING CORP SCHMOYER, w.w. APCI NASA GXYGEN STUDY PRUJECT 00-1-2495.07 APCI-MEMO-71 12/10/71 1P
KRILL, W.R. APCI STANDARD SPECIFICATION FOR A FIELD-FABRICATED CRYUGENIC LIQUID STORAGE-TANK (FLAT-BOT
M) APCI-99820A 18P 9/15/71
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ON FOR JOB-NO-00-2-2775 APCI-NO-71-2775-16.10-1A 2P 9/16/71
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APCI PERSONNEL-PROTECTIVE-EQUIPMENT- WEARING APPAREL HARD HATS APCI-SAFETY-STO-62
APCI WEAR SAFETY SHOES APCI-SAFETY-GRAM-NO-11 2P 5/14/62
SMITH, H.W. APCI PERSONNEL-PROTECTIVE-EQUIPMENT- RESPIRATORY PROTECTIVE EQUIPMENT APCI PRESSURE-GAUGE FAILUKE SAFETY GLASSES SAVE ANGTHER PAIR OF EYFS PRUTECTION ₩ ₩ ₩ SMITH, H.W. APCI PERSONNEL-PROTECTIVE-EQUIPMENT-1P 8/1/63 SOCIETY OF SMITH, H. W. APCI ENG-ST0-546.1 GRAM-NO-29 427P 1965 1.8 108P OFFICE OF AMERICAN 1961 80/ 990003290 990003500 990003310 990003220 990003250 990003390 990003410 990003440 990003450 990003480 990003490 990003510 990003550 091505066 990003170 990003200 990003210 990003240 990003230 990003260 990003270 990003280 990003320 990003330 990003340 990003350 990003360 990003370 990003380 990003400 990003420 990003430 990003460 990003500

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EVERSON; APL MORE ACCIDENTS ON OXYGEN EQUIPMENT APL-SAFETY-BULL-102 1P 2/8/71

EVERSON; LANBA; S. APL BURCKHARDT UXYGEN COMPRESSOR FIRE AT SSPC ROGNAC PLANT 3/2/71 APL-SAFETY-BULL-107 3P 4/14/71

SILLOTT; E. EVERSON; I. APL FAILURE OF BRAZED JOINTS IN HIGH-PRESSURE GASEOUS OXYGEN-LINE AT A CYLINDER SILLOTT; E. EVERSON; I. APL-SAFETY-BULL-114 3P 7/13/71

EVERSON; COCK, P. APL PRELIMINARY REPORT ON ACCIDENT AT ZELZATE PLANT 2/26/69 WHEN AN EXPLOSION AND EVERSON; I. APL SAFETY-DEPT-REP-16 6P 2/28/69 CROXFORD; B. SEEL WORKS/SHOTTON PUMP-TYPE-GBI14-NO-29224 APL-SAFETY-DEPT-REP-16 6P 2/28/69 CROXFORD; B. STEEL WORKS/SHOTTON PUMP-TYPE-GBI14-NO-79 APL-SAFETY-DEPT-REP-26 6P 1/15/70 AT JOHN/SUMMERS STEEL WORKS/SHOTTON PUMP-TYPE-GBI14-SERIAL-NU-79 APL-SAFETY-DEPT-REP-26 6P 1/15/70 APL-SAFETY-DEPT-REP-26 APL-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SAFETY-DEPT-SA
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                             OFFICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE— MINIMUM FEDERAL -STANDAKDS REQUIREMENTS FOR CORROSION CONTRUL FEDERAL REGISTER VOL-36 NO-126 6/30/71
OFFICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE— MINIMUM FEDERAL -STANDARDS EXTENSION OF TIME FOR CONFIRMATION OR REVISION OF MAXIMUM ALLOWABLE OPERATING PRESSURE L REGISTER VOL-36 NO-176 9/10/71
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EVERSON:1. APL ACCIDENT AT AN OXYGEN CHARGING MANIFOLD APL-SAFETY-BULL-046 2P
EVERSON:1. APL ACCIDENT ARISING FROM VENTING-DXYGEN MANIFOLDS CONNECTED TO A COMMON VENT
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                                                                                                                                                                                                                                              MCSWAIN.C.B. APCI ANALYSIS OF WATER-HAMMER IN CRYGGENIC TRANSFER-LINES BIBLIUGRAPHY
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EVERSON,I. APL INVESTIGATION OF VALVE FIRES AT TEXAS INSTRUMENTS LTD-BEDFORD

SP REV-1 2/11/71

EVERSON,I. APL EXPLOSION AND FIRE DUE TO THE CRYOSTAR-GBI14 LOX-PUMP ON AN SSPC

-DEPT-REP-32 9P 7/10/70
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APL ACCEPTANCE TEST FOR CLASS-B CLEANLINESS APL-ENGR-SPEC-A-01 2P 5/12/69
PEGRAM,J.W. APL ACCEPTANCE TESTS FOR CLASS-A CLEANING APL-ENGR-SPEC-A.02 3
PEGRAM,J.W. APL ACCEPTANCE TEST FOR CLASS-AA CLEANLINESS (GXYGEN-CLEAN) AP
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REGISTER VOL-36
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REPORT ON EXPLOSION OF CRYOSIAR-GB.114-PUMP-NO-C.75 ON TANKE ø 9% NICKEL AND HI-PROOF STAINLESS STATIC-TAN 2P Š APL-SAFETY-DEPT-INFO-SHE APL DXYGEN SERVICE APL-IGD-ENGR-MAN-50-03 CHAMBERS, J. APL PROCEDURE FOR THE INSTALLATION OF A CRYOGENIC TANK APL-IGO-ENGR-MAN-60-01 6P 5/19/1 DAVIES, G. APL OVERHAUL PROCEDURE APL-C-155/9.5 33P 1971 APL EXPERIMENTS WITH LIQUID CXYGEN APL-SAFETY-BULL-025 IP REPRINTED 1/68 APL LACK OF OXYGEN KILLS TWO WORKMEN APL-SAFETY-BULL-037 IP REPRINTED 1/68 ZURAWSKI, J. APL REPORT OF THE INVESTIGATION INTO BURCKHARDT CENTRIFUGAL PUMP EXPLOSION AND TANKER FIRE APL-ENGR-STD-LS.31/1 DENISON,D.M. RAF INSTITUTE OF AVIATION NEDICINE FARNBOROUGH HANTS ENGLAND ASSESSMENT OF THE FIRE DENISON,D.M. RAF INSTITUTE OF AVIATION MEDICINE FARNBOROUGH HANTS ENGLAND FIRE RISKS TO MAN OF OXDENISON,D. RAF INSTITUTE OF AVIATION MEDICINE FARNBOROUGH HANTS ENGLAND FIRE RISKS TO MAN OF OXEN RICH GAS ENVIRONMENTS FPRC/MEMO-223 12P 7/65 DENISON,D.M. RAF INSTITUTE OF AVIATION MEDICINE FARNBOROUGH HANTS ENGLAND FURTHER STUDIES UPON THH HUMAN ASPECTS OF FIRE IN ARTIFICIAL GAS ENVIRONMENTS FPRC/1270 28P 9/67 EVER IN ARTIFICIAL GAS ENVIRONMENTS FPRC/1270 28P 9/67 EVERSON,I. APL HAZARD LEVEL OF HYDROCARBON FILMS IN DXYGEN SYSTEMS APL-SAFETY-DEPT-INFO-SHEET-41 GRIFFITHS, D.K. APL RECOMMENDATIONS ARISING FROM EXPLOSION 2/17/71 AS REPORTED IN SAFETY OEPT-REP-35 APL-SAFETY-DE APL-ENGR-STU-LS.31.4 APL-ENGR-STD-LS.31.3 GASEDUS PURGE PROCEDURE FOR CRYDGENIC LIQUID CONTAINER APL-IGD-ENGR-MAN-52-02 7P 6/3/71 PROCEDURE FOR CYLINDER FILLING AND QUALITY CONTROL (STANDARD PURITY GASES) APL PA APL MANUFACTURING QUALITY PROCEDURE FOR DEGREASING OF PIPEWORK APL-QCP-Q11 REV.O 2P APL MANUFACTURING QUALITY PROCEDURE FOR INTERNAL CLEANING OF ALUMINUM TANKERS AND STATIC-TANKS FOR APL-160-ENGR-MAN-50-01 APL-160-ENGR-MAN-50-02 APL DXYGEN PIPELINES APL-ENGR-STD-LS.30/1 8P 7/1/70
APL DESIGN AND SAFETY SATNDARDS FOR CARBON-STEEL GASEOUS DXYGEN TRANSMISSION-LINES
30/2 3P 1/12/70 APPENDIX I THROUGH VI T SHEEPBRIDGE ALLOY CASTINGS LTD APL-MEMO-64 02/5/64 16P EVERSON,I. APL NOTES FOR GUIDANCE OF CUSTOMERS HAVING AIR PRODUCTS LTD DXYGEN EQUIPMENT SURFACES EXPOSED TO APL PIPING SELECTION SHEET-CARBON STEEL-WARM CXYGEN SERVICE 275PSIG (CSG2.7) GENERAL PROCEDURE FOR DECONTAMINATION OF STATIC-TANK AND ROAD-VEHICLE-ASSEMBLIES FOR APL CENTRIFUGAL OXYGEN COMPRESSOR MANUAL HATTINGEN PLANT 15P APPENDIX I II III CHAMBERS,J. APL LOX INSTALLATION AT CUSTOMER SITES APL-IGD-ENGR-MAN-40-01 7P GRAY,G. APL PRGCEDURE FOR FILLING CRYOGENIC TANKER BY PUMP AT CARRINGTON APL-IG APL PROCEDURE FOR FILLING CRYOGENIC TANKERS BY PUMP AT STOKE-ON-TRENT APL PIPING SELECTION SHEET-CARBON STEEL-WARM OXYGEN SERVICE 150PSIG (CSO.1.5) PIPING SELECTION SHEET-CARBON STEEL-WARM OXYGEN SERVICE 500PSIG (CSO5.0) PIPING SELECTION SHEET-CARBON STEEL-HARM OXYGEN SERVICE 720PSIG (CSO7.2) EVERSON, I. APL FIRE HAZARDS IN COMPRESSED-AIR AND OXYGEN RICH ENVIRONMENTS 7P PLUS GRAY, G. APL PROCEDURE FOR FILLING CRYGGENIC TANKERS BY PUMP AT BRACKNELL LIMITING VALUES OF OIL-CONTAMINATION OF STAINLESS-STEEL APL-SAFETY-DEPT-REP-35 APL MANUFACTURING QUALITY PROCEDURE FOR INTERNAL CLEANING OF KS FOR DXYGEN SERVICE APL-QCP-Q13 REV.O 1P APL ALOCLENE-100 AND APPLIED CHEMICALS-5.57 1P 2/5/72 APL. DALL, W.L. BERRITINI, B. APCI EVERSON, I. CRYOSIAR-GB. 114-PUMP-NO-C. 75 AI CARRINGTON CCULSON,K.J. CROXFORD,B.J. EVERSON,I. AF R-400-11 2/17/71 AT THE CARRINGTON PLANT APL-GCP-012 REV.0 1P 3P 7/2/71 9 APL-GCP-Q10 REV.O 2P 6P 1/29/70 FY-DEPT-INFO-SHEET-19 APL ENGR-STD-LS.30/2 APL -ENGR-MAN-55.01 PEGRAM, J. W. 3P 5/27/71 PEGRAM, J. W. PEGRAM, J. W. CHAMBERS, J. CHAMBERS, J. EN SERVICE EVERSON, I. FD-LS.31/2 6/12/10 6/17/10 4/8/11 GKAY, G. 5/27/71 5/27/71 APL APL 990004150 9900C3540 990004190 990004210 990003900 990003970 066800066 990004000 010400066 9900C4020 990004030 990004040 990004050 090500066 990004070 990004080 060500066 990004100 990004110 990004120 990004130 990004140 990004170 081400066 007500066 9900C4220 990004230 990004250 990004260 990004270 990004280 036000066

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SEALANTS AND THREADING COMPOUNDS—CRANE PACKING CO-TAPE APCI-IAZA—09 2P 2/21/72
SEALANTS AND THREADING COMPOUNDS—CRANE PACKING CO-TAPE APCI-IAZA—19 2P 2/21/72
SEALANTS AND THREADING COMPOUNDS—THREE—M FLUGROCARBON—TAPE APCI-IAZA—11 2P 2/21/72
SEALANTS AND THREADING COMPOUNDS—SODIUM—SILICATE AND CHINA—CLAY—PASTE APCI-IAZA—12 1P 2/21/72
THERMAL AND ELECTRICAL INSULATIONS—FOAMGLAS (CELLULAR—GLASS) INSULATION, PITTSBURGH—CORNING CORP
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1P 2/21/72
APCI-IA2A-04 1P 2/21/72
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LUBRICANTS- MOLYLUBE-N BEL-RAY CU FARMINGCALE/NJ APCI-IAIA-12 IP 2/21/72
LUBRICANTS- MOLYLUBE-ND-99, MOLY LUBE PRODUCTS GLEN/COVE/NY APCI-IAIA-13 IP 2/21/72
LUBRICANTS- FLUORO-GLIDE, CHEMPLAST INC APCI-IAIA-14 IP 2/21/72
LUBRICANTS- KRYTOX-143-AD-GIL DUPONT APCI-IAIA-15 IP 2/21/72
LUBRICANTS- VOLTALEF-3A KINGSLEY AND KEITH LTD/UK APCI-IAIA-16 IP 2/21/72
LUBRICANTS- ESSO BEACON-325 APCI-IAIA-17 IP 2/21/72
LUBRICANTS- FORMBLIN-YO4 MONTECATINI-EDISON APCI-IAIA-18 IP 2/21/72
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SEALANTS AND THREADING COMPOUNDS—FERMATEX—IS A PCI = 1A2A—01 1P 2/21/72
SEALANTS AND THREADING COMPOUNDS—FERMATEX—IS A PCI = 1A2A—02 2P 2/21/72
SEALANTS AND THREADING COMPOUNDS—TFILM ECO MFGR CO APCI = 1A2A—03 1P 2/21/72
SEALANTS AND THREADING COMPOUNDS—PUTI = FENDE NATIONAL GREENHOUSE CO APCI = 1A2A—04 1P
SEALANTS AND THREADING COMPOUNDS—GROSSLITE—FLUOROCARBUN—TAPE APCI = 1A2A—06 2P 2/21/72
SEALANTS AND THREADING COMPOUNDS—DAMCO TAPE APCI = 1A2A—06 2P 2/21/72
SEALANTS AND THREADING COMPOUNDS—SANDEN TAPE APCI = 1A2A—07 2P 2/21/72
SEALANTS AND THREADING COMPOUNDS—CRANE PACKING CO-TAPE APCI = 1A2A—09 2P 2/21/72
                                            LUBRICANTS HALOCARBON-11-21E, HALOCARBON PRODUCTS CORPORT APCI-141A-02 IP 2/21/72
LUBRICANTS- HALOCARBON-11-14E, HALOCARBON PRODUCTS CORPORT APCI-141A-03 IP 2/21/72
LUBRICANTS- HALOCARBON-6-25-WAX, HALOCARBON PRODUCTS CORPORT APCI-141A-04 IP 2/21/72
LUBRICANTS- KEL-F-90-GREASE, MINNESOTA MINING MANUFACTURING CO APCI-141A-05 IP 2/21/72
LUBRICANTS- HALOCARBON-25-5S-GREASE, HALOCARBON PRODUCTS CORPORT APCI-141A-06 IP 2/21/72
LUBRICANTS- FLUDROLUBE, FS, HOOKER CHEMICAL APCI-141A-07 IP 2/21/72
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PLASTICS, ELASTOMERS, AND ADHESIVES—KEL—F=B1 APCI—IA4A—03 1P 2/21/72
PLASTICS, ELASTOMERS, AND ADHESIVES—NYLUN APCI—IA4A—04 1P 2/21/72
PLASTICS, ELASTOMERS, AND ADHESIVES—NEOPRENE APCI—IA4A—05 1P 2/21/72
PLASTICS, ELASTOMERS, AND ADHESIVES—VITUN—A APCI—IA4A—06 1P 2/21/72
PLASTICS, ELASTOMERS, AND ADHESIVES—NYLON—66 ICI LTD/UK APCI—IA4A—07 1P 2/21/72
GASKETS AND PACKINGS—GRAPHITE—IMPREGNATED—ASBESTUS—PACKING APCI—IA5A—01 1P 2/21/72
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APCI-IAIA-10 IP 2/21/72
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4/8/11
                          LUBRICANTS- KKYTOX-143-AA-OIL DUPONI
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LUBRICANTS- KRYTOX-143-AC-G1L DUPONT
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THERMAL AND ELECTRICAL
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SURFACE TREATMENTS- COPPER-PIPE ASTM-842 APCI-IA6A-04 IP 2/21/72 SURFACE TREATMENTS- COPPER-TUBE ASTM-875 APCI-IA6A-05 IP 2/21/72 SURFACE TREATMENTS- RED-BRASS-PIPE ASTM-843 APCI-IA6A-06 IP 2/21/72 SURFACE TREATMENTS- ALUMINUM ASTM-8211-2024-74 APCI-IA6A-07 2P 2/21 APCI-IA .6A-13 2P 2/21/72 APCI-1A6A-14 3P -1464-27 2P 2/21/72 APCI-1464-28 2P 2/21/ 2/21/ ASTM-A182-F-316 2/21 2 P 25 2P CUATING 2/21/72 APCI-IA6A-30 APC 1-1 A6A-15 APC 1-1A6A-18 A PC I - I A6 A-19 2 P 2P 2P ASTM-A35368 2 P 2P APC I-1 A6A-16 2P 2/21/72 APCI-1A6A-26 NATURAL-UNTREATED-FINISH APCI-IA6A-23 0 APC I - I A6A-10 APC I-146A-11 APC I - I A6A-12 APCI-IA6A-09 AS APC I-146A-08 STAINLESS STEELS-TYPE-416-CADMIUM-PLATED APC 1-140A-27 APCI-IA6A-13 APCI-1A5A-14 SURFACE TREATMENTS- PLASITE-NO-7122H WISCONSIN PROTECTIVE APCI-IAGA-24 2P STAINLESS STEEL-TYPE-304 UNIDENTIFIED SULDERS, AND SURFACE TREATMENTS- SEALFAS-MASTIC-31-97 BENJAMIN FUSTER AND STAINLESS STEEL ASTM-A182-F-304 AND 9-PERCENT NICKEL STEEL MONEL ASTM-B164 APCI-IA6A-29 2 STAINLESS STEEL ASTM-A351-GR-CF8 APCI-146A-25 CO ASTM-A403-WP304 STAINLESS STEEL ASTM-A312-TP304 ASTM-A320-88304 ASTM-A194-8T321 ALUMINUM B361-WP6061-T6 APCI-CARBUN STEEL (OXYGEN SERVICE) BRUNZE ASTM-B61 OR B62 APCI-BRASS-SHEET UR PLATE ASTM-B36 SURFACE TREATMENTS— BERYLLIUM COPPER — APCI—IA6A—2 SURFACE TREATMENTS— STAINLESS STEEL ASTM—A269—304 STAINLESS STEEL ASTM-A240-304 GASKETS AND PACKINGS- TYGAFLOR CEMENTABLE PTFE TAPES TYGADURE LTD/UK AI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- TARSET PITTSBURGH CHEMICAL METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- CUPPER-SILICON ASTM-898GRB AS TM-B210-6061-T6 TREATMENTS- ALUMINUM ASTM-8241-6061-T6 SURFACE TREATMENTS- ALUMINUM ASTM-B247-6061-T6 SOLUERS, AND SURFACE TREATMENTS- ALUMINUM, ASTM-8-210-3003 AND SURFACE TREATMENTS- ALUMINUM ASTM-8209-5083-0 BRASS GASKETS AND PACKINGS- VITON-A DUPONT APCI-IA5A-10 2P 2/21/72 GASKETS AND PACKINGS- VITON-A DUPONT APCI-IA5A-11 1P 2/21/72 STGS CEMENT CO LTD/UK APCI-IA5A-12 1P 2/21/72 GASKETS AND PACKINGS- KLINGERIT-661 RICHARD KLINGER LTD/UK A5A-13 1P 2/21/72 STAINLESS STEEL STAINLESS STEEL STAINLESS STEFL SURFACE TREATMENTS- FREE-MACHING STAINLESS SURFACE TREATMENTS- ALUMINUM APCI-IA6A-21 2P 2/21/72 I METALS, ALLOYS, SGLDERS, AND SURFACE TREATMENTS-APCI-IA6A-22 2P 2/21/72 SURFACE TREATMENTS-SURFACE TREATMENTS-METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS-METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS-TREATMENTS-AND SURFACE TREATMENTS-TREATMENTS-TR EATMENTS-TR EATMENTS-PCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS-2/21/72 SURFACE TREATMENTS-SURFACE TREATMENTS-TREATMENTS-APCI GASKETS AND PACKINGS- KLINGERIT-661 RICHARD SURFACE SURFACE 1 AND SURFACE ALLOYS, SOLDERS, AND SURFACE SURFACE SURFACE SURF ACE SCLDERS, AND SCLDERS, AND SCLDERS, AND SCLDERS, AND S ONA DNA APCI-IA6A-03 IP 2/21/72
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DI METALS, ALLUYS, SOLDERS, AND AND AND AND SCLOERS, AND AND SOLDERS, AND SOLDERS, AND SOLDERS, AND SCLUERS, AND SCLUERS, AND SOLDERS, SOLDERS, SULDERS, SOLDERS, SOLDERS, ALLOYS, SOLDERS, SOLDERS SOLUERS, SOLDERS, 2P 2/21/72 METALS, ALLOYS, ALLOYS, ALLOYS, ALLOYS, METALS, ALLOYS, IP 2/21/72 ALLOYS, ALLOYS, ALLOYS, ALLOYS, ALLOYS, ALLOYS, ALLOYS, ALL DYS, ALLOYS, ALLOYS, ALLOYS, **ALLUYS**, ALLOYS, ASBESTOS CEMENT 1P 2/21/72 METALS, METALS, METALS, METALS, METALS METLAS, METALS, METALS, METALS, APCI METALS, APCI-IA6A-17 METALS APCI-1A5A-13 APCI GASKETS APCI METALS, ME TALS, METALS, MET ALS, METALS, METALS, METALS ME TALS, METALS METALS, 2/21/72 APCI MET 2/21/12 2/1172 2/112/2 121/12 6A-02 APCI /72 APC 1 APCI APCI /72 APCI APCI APCI A PC I A-20 APC1 772 APCI APCI APCI /21/7 APCI APCI APC I APC I APCI APC I APC I APC I APCI APCI APCI APCI APC 1 APCI APCI APCI EC 990004820 990004830 990004910 006500066 990004950 095700066 990004970 010500066 050500066 9900C5C40 99005050 051500066 990005160 990004840 990004850 990004880 990004890 990004930 056500066 990004980 990004990 990005020 090500066 990005070 990005080 990005100 990005110 990005120 990005130 990005140 021500066 990005000 990005090 098*00066 990004870 990004857

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I-IA6A-31 2P 2/21/72
990005130
           APCI METLAS, ALLUYS, SOLDERS, AND SURGACE TREATMENTS- COPPER-TUBE ASTM-688 APCI-1A6A-32 IP 2/21/72
990005190
           APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- CARBON STEEL- NON-OXYGEN SERVICE WITH POSSIBLE EXP
           USURE TO OXYGEN APCI-IA6A-33 3P 2/21/72
990005200
           APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- SHPEROIDAL-GRAPHITE IRON CONTINENTAL-STANDARD-GGG-3
           8 APCI-IA6A-34 1P 2/21/72
990005210
           APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- SILVER APCI-IA6A-35 IP 2/21/72
990005220
           APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- NOVUNOX STAINLESS STEEL ALLOY TO DIN GERMAN NATIO
           NAL STANDARDS COMPOSITION 5-PERCENT-CR 17-PERCENT-NI 4-PERCENT-CU NIOBIUM STABILIZER BALANCE FE
           PCI-IA6A-36 IP 2/21/72
990005230
           APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- MUNTZ-METAL 60-40-TYPE COMPOSITION CU-58 1-PERC
           ENT ZN38.5-42-PERCENT PB0.35-.9-PERCENT APCI-1A6A-37 1P 2/21/72
990005240
           APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALPHA BRASS-TYPE TCL-100 OR DTD-5019 TUNGUM CO LT
           D/UK COMPOSITION- COPPER-86-PERCENT ALUM-1.20-PERCENT NICKEL-1.4-PERCENT SILICON-1.3-PERCENT IRON-.25-P
           ERCENT LEAD-.O5-PERCENT TIN-.1-PERCENT MANGANESE-.1-PERCENT. TOTAL OTHER IMPURITIES K-PERCENT-ZINC REM
           AINDER APCI-IA6A-38 1P 2/21/72
990005250
           APCI CHEMICALS, SOLVENTS, AND MISC- 1,1 DICHLOROTHANE APCI-IA7A-01 1P 2/21/72
990005260
           APCI CHEMICALS, SOLVENTS, AND MISC- 1,1,1 TRICHLOROETHANE APCI-IA7A-02 1P 2/21/72
990005270
           APCI CHEMICALS, SOLVENTS, AND MISC- CHLORUFORM APCI-1A7A-03 1P 2/21/72
990005280
           APCI CHEMICALS, SOLVENTS, AND MISC- CARBON-TETRACHLORIDE APCI-1A7A-04 1P 2/21/72
990005290
           APCI CHEMICALS, SOLVENTS, AND MISC-TRICHLURGETHYLENE APCI-1A7A-05 1P 2/21/72
           APCI CHEMICALS, SOLVENTS, AND MISC- METHYLENE-CHLORIDE APCI-IA7A-06 1P 2/21/72
990005300
990005310
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, CLEANING-PROCEDURES-APCI
           C-01 14P 2/21/72
990005320
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, CLEANING-PROCEDURES-APL
           -02 1P 2/21/72
990005330
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, QUALITY-CONTROL, FIRE HAZARDS AP
           CI-IBID(1)-1 2P 9/9/71
990005340
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, QUALITY-CONTROL-APCI
                                                                                                    APCI-IBID(2)
           -1 3P 9/9/71
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPARIBILITY, QUALITY-CONTROL-APL APCI-IBID(2)-
990005350
           2 2P 2/21/72
990005360
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY APCI-182-1 2P 2/
           10/72
990005370
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY APCI-182A-1 2P 9
           /2/71
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY NOTCH-SENSITIVITY OF
990005380
            MATERIALS APCI-182C-1 1P 9/2/71
990005390
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY FABRICATION AND WELD
                 APCI-IB2D-1 2P 10/28/71
           APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY MATERIALS AND PARTS
990005400
           SUITABILITY CONTROLS APCI-182E(2)-1 1P 9/2/71
990005410
           APCI OPERATIONAL-HAZARDS- GVERPRESSURE APCI-IIA-1 2P 2/18/72
990005420
           APCI OPERATIONAL-HAZARDS- OVERPRESSURE INTEGRITY OF INSULATION SHOP FABRICATED OX STORAGE TANKS APC
           1-11A4-1 1P 12/30/71
           APCI OPERATIONAL-HAZARDS- OVERPRESSURE INTEGRITY OF INSULATION FIELD FABRICATED FLAT-BOTTOM LOX STORAG
990005430
           E TANKS
                     APCI-11A4-2 1P 12/30/71
990005440
           APCI OPERATIONAL-HAZARDS- DISPOSAL OF VENTED GASES COMPANY PRACTICES APCI-IIB-1 5P 11/1/71
990005450
           APCI OPERATIONAL-HAZAROS- DISPOSAL OF VENTED GASES CLEANLINESS OF DISPOSAL SYSTEM APCI-IIBI-1 2P 2/
           12/72
990005460
           VOID
990005470
           APCI OPERATIONAL-HAZAROS, DISPUSAL OF VENTED GASES CLEANLINESS OF OXYGEN PIPING APCI-IIBI-2 IP 2/19
           172
990005480
           APCI OPERATIONAL-HAZARDS- DISPOSAL OF VENTED GASES PROCEDURAL ARRANGEMENTS APCI-1184-1 1P 2/19/72
990005490
           APCI OPERATIONAL-HAZARDS- COUPLING TO OTHER SYSTEMS APCI-1101-1 APCI-1102-1 IP 12/22/71
           APCI OPERATIONAL-HAZARDS- SPILLS AND LEAKAGE APCI-IIO-1 2P 9/3/71
990005500
           APCI OPERATIONAL-HAZARDS- SPILLS AND LEAKAGE DRAINAGE AND ULTIMATE DISPOSAL ARRANGEMENTS APCI-1101-1
990005510
           2P 8/22/71
990005520
           APCI OPERATIONAL-HAZARDS- SPILLS AND LEAKAGE SEPARATION OF INCOMPATIBLE MATERIALS AND IGNITION SOURCES IN
            UISPUSAL SYSTEMS APCI-1102-1 1P 8/22/71
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APCI-II 04-1 LIMITS SYSTEMS IME WARNINGS AND ESCAPE UPERATIONAL-HAZARDS- SPILLS AND LEAKAGE DETECTION- QUANTITY AND RESPONSE AND LEAKAGE ENVIRONMENTAL OPERATIONAL -HAZAKOS - SPILLS 8/22/71 APCI 99006530 990005540

GPERATIONAL-HÄZARDS- CONTAMINANTS ACUUMULATION APCI-IIE-1 1P 7/21/71 UPERATIONAL-HÄZARDS- OXYGEN-TRANSFER PRODUCTION IO STORAGE, STORAGE 10 SYSTEM, STORAGE TO TRANSPO 8/22/7 APCI APCI

SYSTEM, STORAGE TO TRANSPORT, TRANSPORT, IRANSFER APCI-IIF1-2 IP 8/22/71 AN SPORT TO SYSTEM APCI-LIFI-1 1P 12/22/71
OPERATIONAL-HAZARDS- CXYGEN-TRANSFER PRODUCTION, STORAGE TO SYSTEM,
SYSTEM LOADING AND UNLOADING PROCEDURES FOR LIQUID GXYGEN TRANSFEI RT, TRANSPORT TO SYSTEM 990005560 990005570

INSTALLA OPERATIONAL-HAZARDS- OXYGEN-TRANSFER SYSTEMS SYSTEMS- APL OXYGEN-TRANSFER METHODS TYPICAL AND UPERATIONS DEPARTMENT OVERHAUL PROCEDURES FOR LIQUID PUMPS APCI-11F1-4 1P 2/21/72 UPERATIONAL-HAZARDS- UXYGEN-TRANSFER SYSTEMS SYSTEMS- FIELD FABRICATED CRYOGENIC APCI-11F1-3 1P 2/3/72 APCI ANKS 1 bCI 990005580 990005590

OPERATIONAL-HAZAROS- OXYGEN-TRANSFER PIPELINE-TRANSPORTATION PIPELINE TRANSPORTATION- LIST OF STAND OPERATIONAL-HAZARDS- OXVGEN-TRANSFER PIPELINE-TRANSPORTATION PIPELINE. TRANSPORTATION- APL OXVGEN PI : DESIGN CONCEPTS AND CRITERIA. APCI-IIF2-2. LP. 2/21/72 2P 2/18/72 APCI-11F2-1 ELINE LUNS PCI RDS I Dd I 990005600 079500066

OPERATIONAL-HAZAROS- OXYGEN-TRANSFER ROAD RAILROAD BARGE AND PIPELINE-TRANSPORTATION PRESSURE-REL GPERATIONAL-HAZARDS- OXYGEN-TRANSFER ROAD RAILROAD BARGE AND PIPELINE-TRANSPORTATION CONTAMINATIO APCI-11F24-1 1P 8/22/71 V-CONTROL A PC I 990005620 990005630

ROL APCI-11F2B-1 1P 9/3/71 OPERATIONAL-HAZAROS- OXYGEN-TRANSFER ROAD RAILROAD BARGE AND PIPELINE TRANSPORTATION ROAD, RAILRO PCI 990005640 069500066

4D; BARGE AND PIPELINE TRANSPORTATION OXYGEN-DISPERSAL FROM VENTS AND LINES APCI-IIFEC-1 IP 8/22/71

APCI OPERATIONAL-HAZARDS- OXYGEN-TRANSFÉR ROAD RAILKUAD BARGE AND PIPELINE-TRANSPORTATION ROAD, RAILRO AD, BARGE AND PIPELINE TRANSPORTATION ROAD, RAILRO APCI OPERATIONAL-HAZARDS- OXYGEN-TRANSFER ROAD RAILROAD BARGE AND PIPELINE-TRANSPORTATION ROAD, RAILRO AD, BARGE AND PIPELINE TRANSPORTATION VIBRATION AND CONTROLLED SLOSHING APCI-IIF2E-1 IP 8/22/71

APCI OPERATIONAL-HAZARDS- OXYGEN-TRANSFER MALFUNCTION AND FAILURES APCI INCIDENTS INVOLVING OXYGEN-TRANSFER PALFUNCTION AND FAILURES APCI INCIDENTS INVOLVING OXYGEN-TRANSFER APCI OFFERATIONAL-HAZARDS- OXYGEN-TRANSFER MALFUNCTIONS AND FAILURES APCI INCIDENTS INVOLVING OXYGEN-TRANSFER APCI OFFERATIONAL HAZARDS- OXYGEN-TRANSFER MALFUNCTIONS AND FAILURE INCIDENTS INVOLVING OXYGEN-TRANSFER APCI OFFERATIONAL HAZARDS- OXYGEN-TRANSFER MALFUNCTIONS AND FAILURE INCIDENTS HHICH OCCURRED HITH OTHER UX 990005600

990005670 990005680

MALFUNCTIONS AND FAILURES COMPRESSORS EQUIPMENT APCI-11F3-6 2P 2/3/72

OPERATIONAL-HAZARDS- OXYGEN TRANSFER EQUIPMENT GEN-EQUIPMENT A PC I 059500066

FAILURES GAS-PRESSURE-REGULATORS MALFUNCTIONS AND 1F3-4 15P 1/23/72 OPEFATIONAL-HAZARDS- OXYGEN-TRANSFER EQUIPMENT APCI-11F3A-1 3P 12/10/71 CI-11F3-4 APCI 990005700 990005710

OPERATIONAL-HAZAROS- OXYGEN-TRANSFER MALFUNCTIONS AND FAILURES GEISERING, EXCESSIVE VIBRATIONS, SHOC APC I- [IF3A(3)-1 FAILURES VALVES 2/18/72 OPERATIONAL-HAZAROS- OXYGEN-TRANSFER MALFUNCTIONS AND APCI 9900¢5720 990005730

SYSTEM DUE TO VIBRATIONS APC I-IIIA1-I HAZAROS- FIRES AND EXPLOSIONS APCI-IIG-1 6P 11/1/11 PROGRAM SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW STRUCTURE (THERMAL AND PRESSURF), LINE-SURGES APCI-IIF3B-1 1P 2/18/72 CI OPERATIONAL-HAZARDS- OXYGEN-TRANSFER MALFUNCTIONS AND FAILUPES INSULATION DETERIORATION APCI-11F3C-1 1P 12/30/71 PCI OPERATIONAL-HAZAROS- FIRES AND EXPLOSIONS MAINTENANCE APCI APCI APCI 990005740 990005750 990005760

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9/12/1 APC I-111A2-1 PROGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW LEAKS MAINTENANCE APC I 990005770

APCI-IIIA4-1 INSTRUMENTATION PROGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW INSULATION CHECK SYSTEM PRUGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW APC1-111A3-1 1P 9/12/71 MAINTENANCE MAINTENANCE NYROLS VPCI APCI 990005780 990005190

25 A PC I-1118-1 PROGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW GENERAL CONSIDERATIONS OF MA INTENANCE SYSTEM APCI-IIIA5-1 1P 8/22/71 MAINTENANCE PROGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW PREVENTIVE PROGRAM SAFE CLEANING PROCEDURES FOR FILLTERS, TRAPS, AND INSTRUMENTS 9/12/11 PRUGRAM PRESSURE TESTING APCI-111C-1 3P 59 9/12/71 MAINTENANCE 4PC1-111A5-2 MAINTENANCE A PC I APCI APCI Š 990005800 990005810 990009850 990005830

11/5/11 4 APCI-IVA-1 PLACARDING AR. E.A APCI-IV-I IP 12/23/71 AFETY TRAINING AND ARE SYSTEM-EMERGENCIES APCI-SYSTEM-EMERGENCIES SAFETY MAINTENANCE APCI APC! APC! 990000340 990005850

SYSTEM-EMERGENCIES WARNING DEVICES APCI-IVB-1 5P 11/12/71 SYSTEM-EMERGENCIES PROTECTION PERSONNEL APCI-IVCI-1 6P 1/13/72 SYSTEM-EMERGENCIES PROTECTION BUILDINGS AND ADJACENT SYSTEMS PROTECTION APCI-IVC2-1 4P 1/10/7	ox.	<1	APCI ACCIDENT/INCIDENT INVESTIGATIONS AND REPORTS ACCIDENTS INVOLVING OXYGEN-EQUIPMENT AND SYSTEMS WHIC H CAUSED INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT AND PROPERTY APCI-V-2 26P 2/4/72	GATION AND REPORT APL-SAFETY-BULLETINS AND APL-SAFETY DEPARTMENTS REPORTS; OXYGEN APCI-V-3 2P 2/21/72	APCI LIQUIO AND GASEGUS OXYGEN SAFETY REVIEW DATA- ACCIDENT/INCIDENT INVESTIGATION AND REPURT-APCI DUC UMENTS LIST COVERING SAFETY PRECAUTIONS ACCIDENTS AND NEAR MISSES INVOLVING OXYGEN OR AIR-SEPARATION PLANTS APCI-V-4 2P 5/12/72	DALY, J. APCI BURNING OF METALS IN OXYGEN ATMOSPHERES (80 TO 100-PERCENT) APCI-TM-186 44P 3/72 NIHART, G. J. ET. AL UNION CARBIDE CURP COMPATIBILITY OF MATERIALS WITH 7500-PSI OXYGEN AD608260 71P 10/64	BRYAN•C.J. NASA-KENNEDY MATERIALS COMPATIBILITY FOR GASEOUS OXYGEN SYSTEMS MAB-3268-69 9P 11/5/69 Merkblatter german pressure vessel code-ad merkblatter (english translation) 304P 9/71	YGEN DIFFUSION IN THE ATMOSPHERE FROM LIQUID OXYGEN POOLS ADVANCES IN P555-565 11P 1968	LAPIN,A. FOSTER,R.H. APCI GXYGEN DIFFUSION IN THE ATMOSPHERE FROM LIQUID GXYGEN PUGLS CGA AIR-SE PARATION PLANT SAFETY SYMPOSIUM P12-23 12P 4/23/69	CRYDGENIC SAFETY CONFERENCE ALLENTOWN 145P 7/59
APCI PPCI	APCI SYSTEM-EMERGENCIES HAZARDS PAPCI SYSTEM-EMERGENCIES HAZARDS PGEN-SAFETY APCI-IV 2 IP 2/21/7	APCI ACCIDENT/INCIDENT INVESTIGATI	APCI ACCIDENT/INCIDENT INVESTIGATI H CAUSED INJURY TO PERSONNEL OR	APCI ACCIDENT-INCIDENT INVESTIGATION AND REPORT APL-SAFETY-BULI RELATED TO ACCIDENTS INVOLVING OXYGEN APCI-V-3 2P 2/21/72	APCI LIQUID AND GASEOUS OXYGEN SAFETY UMENTS LIST COVERING SAFETY PRECAUTION PLANTS APCI-V-4 2P 5/12/72	DALY, J. APCI BURNING OF METALS IN NIHART, G. J. ET. AL UNION CARBIDE 10/64	BRYAN, C. J. NASA-KENNEDY MATERIALS MERKBLATTER GERMAN PRESSURE VESSEL	LAPIN, A. FOSTER, R.H. APCI OXYGEN DIFFUSION IN 'CRYDGENIC ENGINEERING V-13 P555-565 11P 1968	LAPIN, A. FOSTER, R.H. APCI DXYGEN PARATION PLANT SAFETY SYMPOSIUM	APCI CRYOGENIC SAFETY APCI CRYO
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- %	BALL, W.L. APCI MINUTES OF CGA AIR-SEPARATION EQUIPMENT COMMITTEE HELD AT FT/LA SCHMOVER, W.W. BALL, APCI MISTY PROBLEM VAPOR-CLOUDS FROM DEFROIS OPERATIONS ALLEGEDLY CAU BALL, APCI OXYGEN COMPRESSOR FIRE APCI-SAFETY-GRAH-NO-03 2P 7/7/61 BALL, W.L. APCI DLANT-SITE RITERIA- AIR-SEPARATION ARCI-SAFETY-STD-605.1 9P BALL, W.L. APCI PRORT OF OXYGEN PUMP EXPLOSION AIRCO-BUTLER APCI-MEMO-63 10/2 BASSLER, E. APCI PRODUCTION OF ROCK WOOL BETHLEHEM—STEEL-CO APCI-MEMO-69 11/12 BASSLER, E. J. APCI CLEANING FOR UXYGEN SERVICE 17P 1/60 BASSLER, E.J. APCI BEHAVIOR OF ROCK WOOL BETHLEHEM—STEEL-CO APCI-MEMO-59 11/12 BAUGR, H. WEGENER, W. MINDGASSEN, K.F. FIRE TESTS ON CENTRIFUGAL PUMPS FOR LIQUID-BEREETIINI, B.J. APCI LCX-PUMP FIRES AND EXPLOSIONS APCI-MEMO-70 06/26/770 3P	in in the second	BUYNTON,M.C.W. BROWN,G.I. SHEPHERD,N. EVERSON,I. APL EXPLOSION ON OXY-FUEL-BURNER EQUIPMENT BRYAN,C.J. NASA-KENNEDY MATERIALS COMPATIBILITY FUR GASEOUS GXYGEN SYSTEMS MA CAMPBELL,R.W. TAYLOR, B.W. APCI USE OF PERLITE IN AIR-SEPARATION COLO-BOXES AP CHAMBERS,J. APL LOX INSTALLATION AT CUSTOMER SITES APL-IGD-ENGR-MAN-4G-01 7 CHAMBERS,J. APL PROCEDURE FOR CYLINDER FILLING AND QUALITY CONTROL (STANDARD CHAMBERS,J. APL PROCEDURE FOR THE INSTALLATION OF A CRYOGENIC TANK APL-IGD-ENG CHAMBERS,J. APL PROCEDURE FOR CRYOGENIC LIQUID CONTAINER APL-IGD-ENGR-M EVERSON,I. COUK,P. APL PRELIMINARY REPORT ON ACCIDENT AT ZELZATE PLANT ZZZZZZO, WHEN AN EX
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                                                                                                                                           DALY, J. APCI BURNING OF METALS IN DXYGEN ATMUSPHERES (80 TO 100-PERCENT) APDAVIES, G. APL OVERHAUL PROCEDURE APL-C-155/9, S. 33P 1971
DEAN, L. E. THOMPSON, W.R. AEROJET-GENERAL CORP IGNITION CHARACTERISTICS OF METALS
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DINAN, E.R. APCI INVESTIGATION OF THE FIRE-RESISTANT QUALITIES OF CELLULUBE-220,
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TEFLUN TAPE PERCENT ETHER EXTRACIABLE CONTAMINANTS AND FLUORES
SHAW, D.A. APCI GXYGEN INDEX FATING VITON-O-RING MATERIAL- V
SHAW, D.A. APCI GXYGEN INDEX RATING SILICONE-O-RING (1/8-IN
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PREDERICKL.GG LATSHAW, D.R. APCI GXYGEN COMPATABILITY WITH TWO-PART EPOXY-COMPOSITED WASS-KENNEDY FREE INTELEMENTAL APCI CONTROLLED KINETICS EXPERIENTS—TELLUM-1955, SUPPORTED BY 76-8 GG151-JAM. APCI CONTROLLED KINETICS EXPERIENTS—TELLUM-1955, SUPPORTED BY 76-8 GG11LOTTIC. FYEESON, J. APL PROCEDORE FOR FILLING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCONS ON CILLOTTIC. APL SOLUM WASSING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCONS ON CASCAPACIA. APL PROCEDORE FOR FILLING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCONS ON CASCAPACIA. APL PROCEDORE FOR FILLING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCONS ON CASCAPACIA. APL PROCEDORE FOR FILLING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCONS ON CASCAPACIA. APL PROCEDORE FOR FILLING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCONS ON CASCAPACIA. APL PROCEDORE FOR FILLING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCONS ON CASCAPACIA. APL PROCEDORE FOR FILLING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCAPACIA. APL PROCEDORE FOR FILLING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCAPACIA. APL PROCEDORE FOR FILLING CONCENCE TANKER BY PURP A TIGHT-PRESSURE CASCAPACIA. APL PROCEDORE FOR FILLING CONTENT OF THE PRESSURE CASCAPACIA. APL PROCEDORE FOR FILLING CONTENT OF THE PRESSURE CASCAPACIA. APL PROCEDORE FOR FILLING CONTENT OF THE PRESSURE CASCAPACIA. APL DESCRIPTA APL COUNTRY OF THE PRESSURE CASCAPACIA. APL DESCRIPTA APL CASCAPACIA. APL DESCRIPTA APL CASCAPACIA. APL DESCRIPTA APL DESCRIPTA APL CASCAPACIA. APL DESCRIPTA APL DESCRIPTA APL CASCAPACIA. APL DESCRIPTA APL DESCRIPTA APL CAS
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990000030		KITSON, F. K. APCI LIQUID OXYGEN LOADING APCI-SAFETY-GRAM-NU-06 1P 11/17/61
990002760		KITSON, F.K. APCI NASH VACUUM PUMPS APCI MEMO-71 01/19/71 2P
990000440		
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		KITSON, F.K. APCI STAFFING AND CHECK-IN SYSTEMS FOR OPERATING-PLANTS APCI-ME
990002 7 50 990000920		KITSON, F.K. APCI SUMMARY OF ACTION TAKEN ON PRESSURE-GAUGES APCI-MEMO-61 08/2
		KITSON, F.K. APCI WASHOUT ANALYSIS OF SUN-OIL COMPANY_S LOX-TANK VAPORIZER APC
990002900		KOKINDA, J. J. APCI 1200-SERIES REGULATOR- MATERIAL OF CONSTRUCTION 231-G-120054
990003420		KRILL, W.R. APCI JOB SPECIFICATION 310000 GALLUN CAPACITY LOX/LIN STORAGE TANK
990003410		KRILL, W.R. APCI STANDARD SPECIFICATION FOR A FIELD-FABRICATED CRYOGENIC LIQUID S
990002150	LOUSHIN, L.L.	LAMBERTIN, W.J. PALMER, A.J. ESSO APPLICATION OF FRACTURE-MECHANICS TO SAFE-LIFE
990003860	EVERSON, I.	LANBA, J.S. APL BURCKHARDT DXYGEN COMPRESSOR FIRE AT SSPC ROGNAC PLANT 3/2/71
990002940		LANG, A. LINDE AIR-FRACTIONATION PLANT EXPLOSION AICHE-CEP-TECH-MANUAL SAFETY
99000000		LAPIN,A. FOSTER,R.H. APCI UXYGEN DIFFUSION IN THE ATMOSPHERE FROM LIQUID OXY
990005990		LAPIN,A. FOSTER,R.H. APCI OXYGEN DIFFUSION IN THE ATMOSPHERE FROM LIQUID OXY
990002210		LAPIN, A. APCI DISCUSSION WITH MR E LUCAS-IPD INSPECTION, REGARDING APCI CLEANLI
990002220		LAPIN.A. APCI TELEPHONE CONVERSATION WITH MR WILLIAM MCCORMICK REGARDING REQUI
990002910		LAPIN, A. APCI TESTING OF SCREENS TO BE USED IN OXYGEN COMPRESSOR SUCTION APCI
990003090	FREDERICK, L.G.	LATSHAW, D.R. APCI COMPATIBILITY OF MATERIAL WITH OXYGEN JOHNS-MANVILLE ASBESTOS
990003110	FREDERICK, L.G.	LATSHAW, D.R. APCI FLUORESCENCE OF VARIOUS TYPES OF DILS- MOBIL-DTE-105 TEXACO-CA
990001420	•	LATSHAW, D. R. APCI GASKET MATERIALS COMPATBILITY OF GASKET MATERIALS WITH DXYGE
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990002170		LATSHAW, D.R. APCI OXYGEN SAFETY REVIEW CHECK-LIST APCI-MEMO-71 05/4/71 3P
990003040	FREDERICK, L.G.	LATSHAW, D.R. APCI OXYGEN INDEX RATING VITON-D-RING MATERIAL- VITON-E-60 (GREE
990003120	FREDERICK, L.G.	LATSHAW, D.R. APCI UXYGEN COMPATABILITY WITH TWO-PART EPOXY-COMPOUND (7343-RESI
990003060	FREDERICK, L.G.	LATSHAW, D.R. APCI DXYGEN INDEX RATING SILICONE-D-RING (1/8-INCH DIA) APCI-
990003130	FREDERICK,L.G.	The state of the s
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	MATHEWS, L.G.	LINDE UXYGEN PLANT EXPLUSION AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA
990002150		LOUSHIN, L.L. LAMBERTIN, W.J. PALMER, A.J. ESSO APPLICATION OF FRACTURE-MECHANICS
990002850		MAHR, A.J. APCI LIST OF CLEANING-AGENTS, ASSOCIATED EQUIPMENT AND SUPPLIES APPRO
990000970		MASTER, H. H. APCI AIR-SEPARATION-PLANT CONTAMINATION- HISTORY, SAMPLING, AND ANA
990002490		MASTER, H. H. APCI AUTO LOAD SYSTEMS APCI-MEMO-71 05/4/71 2P PLUS 3P ATTACHM
990002480		MASTER, H. H. APCI LATHROP AUTO-LOAD SYSTEM APCI-MEMO-71 03/22/71 2P PLUS 3P
990000910		MASTER, H. H. APCI LOX TANKS APCI-MEMU-70 06/26/70 1P
990002650		MASTER, H. H. APCI LOX TRANSFER PUMPS APCI-MEMO-68 12/30/68 2P PLUS 2P ATTAC
990002660		MASTER: H. H. APCI LOX TRANSFER PUMP SCREENS APCI-MEMO-69 01/24/69 2P PLUS 3P
990002790		MASTER, H. H. APCI NEAR-MISS ACCIDENT- BURNS/HARBOR APCI-MEMU-71 02/8/71 2P
990003240		MASTER, H. H. APCI OPERATIONS HEARING PROTECTION PROGRAM APCI-MEMO-71 04/7/71
990002640		MASTER, H. H. APCI OXYGEN PIPE-LINE FAILURE APCI-MEMO-67 12/29/67 1P
990002730		MASTER, H. H. APCI OXYGEN FLOW-METER RING SEAL-FLUID APCI-MEMO-70 02/27/70 1P
990002320		MASTER, H. H. APCI PLANT PREVENTIVE MAINTENANCE-CONTROL 9P PLUS EXHIBIT-A-1, A-
990002510		MASTER, H. H. APCI PRODUCT VAPOR HAZARDS- SAFETY INFORMATION RELATIVE TO LIQUID-V
990000690		MASTER,H.H. APCI STORAGE TANK CLEANING APCI-MEMO-63 01/24/63 1P
990002980		MATHEMS, L.G. LINDE OXYGEN PLANT EXPLOSION AICHE-CEP-TECH-MANUAL SAFETY IN AI
990001030		MATHEWS, W. D. OWEN, G.G. IMPERIAL CHEMICAL INDUSTRIES LTD SAFETY ASPECTS OF RECO
990003580		MCSWAIN.C.B. APCI ANALYSIS OF WATER-HAMMER IN CRYOGENIC TRANSFER-LINES BIBLIOGR
990001520	JACKSUN, J. D. BUYD, W.K.	MILLER, P.D. BATTELLE MEMORIAL INSTITUTE REACTIVITY OF METALS WITH LIQUID AND
990003020	•	MOGRE, A.A. APL REPORT ON SERVICE VISIT TO H.M.SEAGLE APL-X0425 5P PLUS AP
990001210		MOYSAN, S.R. APCI SAFETY-VALVE-SEAT OXOMAT FLAMMABILITY IN 100-PERCENT GASEBUS
990001430		MOYSAN, S.R. APCI VALVE MASHERS NEW AND USED QUALITATIVE AND QUANTITATIVE OIL AN
990003890	CROXFORD.B.J. EVERSON.I.	NAYLOR, R. APL REPORT ON EXPLOSION OF LOX-PUMP ON TANKER-400-11 1/7/70 AT JOHN/S
990005960	y	NIHART, G.J. ET.AL UNIGN CARBIDE CORP COMPATIBILITY OF MATERIALS WITH 7500-PSI
990003050		NISSLER, K. H. DEMAG KA-27-IV/KA-4-IV JXYGEN CUMPRESSOR VITON-A (BLACK) VITON-E60
990003350		UEHMKE, G.R. APCI GENERAL SPECIFICATION FOR CLEANING FOR OXYGEN SERVICE APCI-5
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990003360		OEHMKE, G.R. APCI GENERAL SPECIFICATION FOR CENTRIFUGAL COMPRESSORS APCI-550-SD
990003710		OLIVER, R. APL CENTRIFUGAL CRYOGENIC PUMPS APL-ENGR-SPEC-G.03 14P 4/1/71
990001030	MATHEWS . W. D.	OHEN, G.G. IMPERIAL CHEMICAL INDUSTRIES LTD SAFETY ASPECTS OF RECONSTRUCTED ICI
990002150 USHIN.L	.L. LAMBERTIN, W.J.	PALMER, A.J. ESSO APPLICATION OF FRACTURE-MECHANICS TO SAFE-LIFE DESIGN IN CRYUG
990001890	•	PECKHAM, H. M. HAUSER, R.L. MARTIN CO COMPATIBILITY OF MATERIALS WITH LIQUID DXYG
990003610		PEGRAM, J.W. APL ACCEPTANCE TESTS FOR CLASS-A CLEANING APL-ENGR-SPEC-A.OZ 3P
990003620		PEGRAM, J. W. APL ACCEPTANCE TEST FOR CLASS-AA CLEANLINESS (OXYGEN-CLEAN) APL-F
990003680		PEGRAM, J.W. APL BRAZED CORE EXTENDED SURFACE HEAT-EXCHANGERS APL-ENGR-SPEC-E.O
990003780		PEGRAM, J.W. APL CRYGGENIC LIQUID HOSE-COUPLINGS FOR USE IN THE U.K APL-ENGR-
990003630		PEGRAM, J. W. APL DEGREASING ACCEPTANCE TESTS FOR UXYGEN SERVICE COMPRESSORS AP
990004050		PEGRAM, J. W. APL DESIGN AND SAFETY SATNDARDS FOR CARBON-STEEL GASEOUS DXYGEN T
990003790		PEGRAM, J. W. APL EXPANDED PERLITE APL-ENGR-SPEC-N. 01 3P 1/2/70
990003760		PEGRAMALAWA API ELEXIBLE HOSES FOR CHARGING AND DISCHARGING MANIFOLDS DAYGEN
990003810		PEGRAM, J.W. APL INSULATION- PREFORMED CELLULAR GLASS SECTION FOR PIPELINES AP
990003800		PEGRAM, J. W. APL MINERAL WOOL APL-ENGR-SPEC-N. 02 3P 1/2/70
990004040		PEGRAM, J. W. APL OXYGEN PIPELINES APL-ENGR-STD-LS. 30/1 8P 7/1/70
990004070		PEGRAM, J. W. APL PIPING SELECTION SHEET-CARBON STEEL-WARM OXYGEN SERVICE 275PSI
990003730		PEGRAM, J. W. APL PRESSURE REGULATING-VALVES FOR OXYGEN SERVICE APL-ENGR-SPEC-J.
990003720		PEGRAM, J.W. APL PRESSURE-GAUGE- OXYGEN SERVICE APL-ENGR-SPEC-J. 07 3P 6/18/69
990003740		PEGRAM, J.W. APL RELIEF VALVES, WARM GAS SERVICE -20F TO 100F APL-ENGR-SPEC-
990003670		PEGRAM, J.W. APL SPECIFICATION FOR OXYGEN SERVICE PRESSURE-VESSEL FABRICATION
990003660		PEGRAM, J.W. APL SPECIFICATION FOR OXYGEN SERVICE VESSEL FABRICATION APL-ENGR-
990003750		PEGRAM, J.W. APL TRANSFER HOSE FOR CRYOGENIC LIQUIDS APL-ENGR-SPEC-L.11 3P
990003770		PEGRAM, J. W. APL UNSINTERED P.T.F.E. TAPE APL-ENGR-SPEC-L.14 2P 7/8/69
990003640		PEGRAM, J.W. APL VALVES-DXYGEN SERVICE-MINIMUM DECONTAMINATION AND TEST REQUIREME
990002590	DUFFALA . S . H .	PIEMME, A.G. LINDE ACCIDENT AND FIRE IN DXYGEN GENERATING PLANT AT GREAT-LAKES-
990002990		PINNEY, G.G. NATIONAL CYLINDER GAS CO OXYGEN TRAILER FIRE AICHE-CEP-TECH-MAN
99000261A	DUFFALA,S.H. KEY,C.F. KEY,C.F.	RENDOS, J.J. AIRCO DESCRIPTION OF AN AIR-SEPARATION PLANT EXPLOSION AICHE-CEP-
990002630		RENDOS, J.J. AIRCO LIQUID OXYGEN PUMP FAILURES RE-99000301
990003010		RENDOS, J.J. AIRCO LIQUID OXYGEN PUMP FAILURES AICHE-CEP-TECH-MANUAL SAFETY IN
990002950		REYNOLDS, P.W. IMPERIAL CHEMICAL INDUSTRIES SAFETY IN AIR AND AMMONIA PLANTS
990001270	KEY, C.F.	RIGHL, W.A. NASA-HUNTSVILLE COMPATIBILITY OF MATERIALS WITH LIQUID DXYGEN NASA-
990001280	KEY,C.F.	RIEHL, W.A. NASA-HUNTSVILLE COMPATIBILITY OF MATERIALS WITH LIQUID DXYGEN MTP-P
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990002130	ERDOGAN,F.	ROBERTS, R. LEHIGH UNIV COMPARATIVE STUDY OF CRACK-PROPAGATION IN PLATES UNDER
990003100		ROBINSON, G.W. APCI LOX COMPATIBLE GASKET MATERIALS GARLOCK-900 DURABLA JOHNS-MA
990002960		ROTZLER,R.W. ET.AL OXYGEN PLANT REBOILER EXPLOSION AICHE-CEP-TECH-MANUAL SAFE SCHMAUCH.G.E. APCI FLAMMABILITY TESTS ON INSULATION MATERIALS VASCOCEL MILEDAM N
990002930		SCHMAUCH,G.E. APCI FLAMMABILITY TESTS ON INSULATION MATERIALS VASCOCEL MILFOAM N SCHMOYER,W.W. BALL,W.L. APCI MISTY PROBLEM VAPOR-CLOUDS FROM DEFROST OPERATION
990002500 990003190		SCHMOYER, W. W. APCI AND THEN THERE WAS DARKNESS APCI-SAFETY-GRAM-NO-58 1P 3/1
990001060		SCHMOYER, W. W. APCI CARBON-TETRACHLORIDE APCI-SAFETY-GRAM-NO-68 1P 2/21/69
990000560		SCHMOVER, W. W. APCI CAUTION- SNIFF TESTING CYLINDERS HAS ITS HAZARDS APCI-SAFET
990000510		SCHMOVER, W. W. APCI COMPATIBILITY OF MATERIALS - DXYGEN COMPATIBLE MATERIALS - APC
990000080		SCHMOYER, W. W. APCI DRAIN-LINE EXPLOSION APCI-SAFETY-GRAM-NO-24 2P 1/17/63
990000070		SCHMOYER, W. W. APCI GASEOUS DXYGEN APCI-SAFETY-GRAM-NU-23C 6P 1/10/63
990001380		SCHMOYER, W. W. APCI HALOCARBON-WAX-6-25 APCI-MEMO-69 02/6/69 1P
990000130		SCHMOYER, W. W. APCI HUMAN TORCHES APCI-SAFETY-GRAM-NO-50C 1P 1/3/66
990000170		SCHMOYER, W. W. APCI LIQUID OXYGEN APCI-SAFETY-GRAM-NO-54C 6P 1/31/67 P6 REV
990000090		SCHMOYER, HOW. APCI LUBRICANTS AND THREAD COMPOUNDS FOR OXYGEN-SYSTEMS APCI-SAF
990003400		SCHMUYER, W.W. APCI NASA GXYGEN STUDY PROJECT 00-1-2495.07 APCI-MEMO-71 12/10
990000050		SCHMCYER, W. W. APCI OXYGEN CYLINDER FAILURE APCI-SAFETY-GRAM-NO-13 2P 6/1/62
990000140		SCHMOYER, W. W. APCI OXYGEN REGULATORS IN THE WELDING INDUSTRY APCI-SAFETY-GRAM-
990000490		SCHMOYER, w. w. APCI PLANT COMPONENTS- STURAGE, VACUUM-SYSTEMS, AND COMPRESSED-GAS

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                                             KENDOS,J.J. *AIRCO DESCRIPTION OF AN AIR—SEPARATION PLANT EXPLOSION RENDOS,J.J. *AIRCO LIQUID OXYGEN PUMP FAILURES RE—99000301
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INSTRUMENTATION PRESSURE REQUIREMENTS SAFETY AND KELIEF VALVES APCI-DES-EN INSULATION AND PAINTING COLD-BOXES, THERMAL TANKS, GLASS WOUL APCI-DES-EN INSULATION AND PAINTING COLD-INSULATION AND MINERAL FIBER GRANULATED APCI INSULATION AND PAINTING COLD-BOXES THERMAL TANKS PERLITE APCI-DES-ENG-STD INSULATION MATERIALS FOR CRYDGENIC SYSTEMS MILEGAM WRETHANE INSULATION NOT THE FIRE-RESISTANT QUALITIES OF CELLULUBG-220, CELLULUBE-15
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JGB SPECIFICATION 310000 GALLON CAPACITY LOX/LIN STORAGE TANK APCI-JOB
KEL-F HIGH-PRESSURE DXXGEN COMPATIBILITY- NYLUN APCI-MEMO-63 05/17/63 IP
LATHROP AUTO-LOAD SYSTEM APCI-MEMO-71 03/22/71 2P PLUS 3P ATTACHMENTS
LIQUID AND GASGOUS GXYGEN SAFETY REVIEW DATA- ACCIDENT/INCIDENT INVESTIGAT
LIQUID DXXGEN APCI-SAFETY-GRAM-NO-54C 6P 1/31/67 P6 REVISED 1/31/68
LIQUID OXYGEN LOADING APCI-SAFETY-GRAM-NO-00 IP 11/17/61
                                                                            GASKETS AND PACKINGS- VITON-A DUPUNT APCI-IA5A-11 IP 2/21/72
GASKETS AND PACKINGS- KM246 SHEET-ASBESTOS GASKET MATERIAL NICOLET INDUSTR
GASKETS AND PACKINGS- TYGAFLOR CEMENTABLE PIFE TAPES TYGADURE LTD/UK A
GASKETS AND PACKINGS- KLINGERIT-661 RICHARD KLINGER LTD/UK
                                                                                                                                                                                             TEFLON, DUPONT APCI-1A5A-10 2P 2/21/72
SINDANYO CS-51-ASBESTUS AND CEMENT BOARDS, NATURAL-U
                                                                                                                                                                                                                                                           GENERAL SPECIFICATION FOR CLEANING FOR OXYGEN SERVICE APCI-550-SD-274 5P GENERAL SPECIFICATION FOR CENTRIFUGAL COMPRESSORS APCI-550-SD-164 37P 4/GENERAL SPECIFICATION FOR RECIPROCATING COMPRESSORS APCI-550-SD-01A 37P
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                                                        APC1-1A5A-03
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                         GASKET MATERIAL)
APCI-1A5A-08
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APCI-MEMU-68 12/30/68 2P PLUS 2P AT
XPLCSIONS APCI-MEMU-70 06/26/70 3P
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LOX AND LIN VAPOR DISPOSAL-TANK-500-GAL APCI-DRAWING-9248
                       MELRATH-150 (SHEET-ASBESTUS GASKET VALLEGREEN, VALLEGREEN, VALLEY/FORGE GASKET CO
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  VULCANIZED-RED-FIBRE-GASKETS
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                                                             PACKINGS- VALLEGREEN, VALL PACKINGS- VITON-A DUPONT
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                      SCHMOYER, W. H. + APCI LUBRICANTS AND THREAD COMPOUNDS FOR OXYGEN-SYSTEMS APCI-SAFETY-GRAM-NO-27
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                                           LUBRICANTS- ESSO BEACUN-325 APCI-IAIA-17 IP 2/21/72
990004420
                                           LUBRICANTS- FLUORO-GLIDE, CHEMPLAST INC APCI-1414-14 1P 2/21/72
990004390
                                    +APCI LUBRICANTS- FLUOROLUBE, FS-5, HOOKER CHEMICAL APCI-IAIA-11 1P 2/21/72
990004350
                                           LUBRICANTS- FLUOROLUBE; FS, HUOKER CHEMICAL APCI-IA1A-07 1P 2/21/72
990004460
                                           LUBRICANTS- FORMBLIN-YO4 MONTECATINI-EDISON APCI-IA1A-18 1P 2/21/72
990004320
                                           LUBRICANTS- HALOCARBON-6-25-WAX, HALOCARBON PRODUCTS CORP APCI-IAIA-04 1P
990004300
                                    +APCI
                                           LUBRICANTS- HALOCARBON-11-21E, HALOCARBON PRODUCTS CORP. APCI-1A1A-02 1P
990004340
                                    +APCI
                                           LUBRICANTS- HALOCARBON-25-5S-GREASE, HALOCARBON PRODUCTS CORP APCI-IAIA-06
990004310
                                    +APCI
                                           LUBRICANTS- HALOCARBON-11-14E, HALOCARBON PRODUCTS CORP APCI-1A1A-03 1P
990004330
                                    +APCI
                                           LUBRICANTS- KEL-F-90-GREASE. MINNESOTA MINING MANUFACTURING CO APCI-IA
990004380
                                    +APC I
                                           LUBRICANTS- KRYTOX-143-AZ-OIL DUPONT APCI-IAIA-10 IP 2/21/72
990004570
                                    +APC I
                                           LUBRICANTS- KRYTOX-143-AC-OIL DUPONT
                                                                                 APCI-IA1A-09 1P 2/21/72
990004290
                                    *APCI
                                           LUBRICANTS- KRYTOX-143-AA-DIL DUPONT
                                                                                 APCI-IAIA-01 1P 2/21/72
990004360
                                           LUBRICANTS- KRYTOX-143-AB-OIL DUPONT
                                                                                 APCI-IA1A-08
                                                                                               IP 2/21/72
990004430
                                    +APC I
                                           LUBRICANTS- KRYTOX-143-AD-OIL DUPONT
                                                                                 APCI-IALA-15 1P 2/21/72
990004410
                                    +APC I
                                           LUBRICANTS- MOLY-LUBE-NO-99, MOLY LUBE PRODUCTS GLEN/COVE/NY APCI-IA1A-1
990004400
                                           LUBRICANTS- MOLYLUBE-N BEL-RAY CO FARMINGDALE/NJ APCI-IA1A-12 1P 2/21/
                                    + APC I
990004440
                                           LUBRICANTS- VOLTALEF-3A KINGSLEY AND KEITH LTD/UK APCI-IA1A-16 1P 2/21
                                    +APC1
990000270
                                    +APCI
                                           MACHINERY- FIELD TESTING AND CENTRIFUGAL DXYGEN COMPRESSORS APCI-DES-ENG-S
990000260
                                          MACHINERY- FIELD TESTING AND RECIPROCATING DXYGEN COMPRESSORS APCI-DES-ENG
990001930
                                    +APCI
                                           MAINTENANCE AND INSPECTION REQUIREMENTS FOR BULK LIQUID CUSTOMER INSTALLATI
990001920
                                    +APCI
                                           MAINTENANCE AND INSEPCTION REQUIREMENTS FOR CUSTOMER BULK GAS SUPPLY SYSTEM
990005770
                                    +APCI
                                           MAINTENANCE PROGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW LEAKS
990005780
                                    *APCI
                                           MAINTENANCE
                                                        PROGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW SYSTEM
990005830
                                    +APC I
                                           MAINTENANCE
                                                        PROGRAM PRESSURE TESTING APCI-ITIC-1 3P 9/12/71
                                                        PROGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW INSULATI
990005790
                                    +APCI
                                           MAINTENANCE
                                                        PROGRAM SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW STRUCTURE
990005760
                                    +APCI
                                           MAINTENANCE
990005800
                                                        PROGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW GENERAL
                                           MAINTENANCE
990005820
                                           MAINTENANCE
                                                       PROGRAM SAFE CLEANING PROCEDURES FOR FILTERS, TRAPS, AND INSTRU
990005810
                                    +APC I
                                           MAINTENANCE PROGRAM- SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW PREVEN
990003310
                                    +APCI
                                           MAINTENANCE OF PORTABLE FIRE-EXTINGUISHERS APCI-PUM-SEC-1.13 5P 3/30/67
                        SCHNYDER , R. +APCI
990003080
                                           MASTER DRAWING 1200-SERIES REGULATIONS APCI-DRAWING-000-0-407004E 1P 3/4
990005330
                                           MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, QUALITY-CON
990005320
                                           MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, CLEANING-PR
990005350
                                           MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPARIBILITY, QUALITY-CON
990005390
                                           MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBIL
990005340
                                    +APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, QUALITY-CON
990005370
                                           MATERIAL-COMPATIBLEITY, COMPATIBLEITY CHECK, STRUCTURAL-MATERIALS-COMPATIBLE
990005310
                                    +APCI MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, CLEANING-PR
990005380
                                           MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBIL
990005400
                                           MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBIL
990005360
                                           MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBIL
990005110
                                           METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- BERYLLIUM COPPER APCI-1A6
990005230
                                           METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- MUNTZ-METAL 60-40-TYPE CO
990005170
                                           METALS, ALLOYS, SULDERS, AND SURFACE TREATMENTS- STAINLESS 9-PERCENT NICKEL
                                    +APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALPHA BRASS-TYPE TCL-100 OR
990005240
990005120
                                    +APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL 4STM-A269-3
990005200
                                           METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- SHPEROIDAL-GRAPHITE IRON CO
990005150
                                    +APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- MONEL ASTM-B164 APCI-IA6A
990005210
                                    +APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- SILVER APCI-1A6A-35 1P
990005130
                                    *APCI METALS, ALLOYS, SULDERS, AND SURFACE TREATMENTS- BRONZE ASTM-B61 OR B62 A
990005160
                                    *APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A351-G
990005220
                                    +APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- NOVONOX STAINLESS STEEL AL
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SURFACE TREATMENTS— ALUMINUM ASIM—WEGGELTG A SURFACE TREATMENTS— ALUMINUM ASIM—B241—6061—16 SURFACE TREATMENTS— CARBON STEEL (OXYGEN SERVI SURFACE TREATMENTS— STAINLESS STEEL ASIM—A182—F SURFACE TREATMENTS— SEALFAS—MASTIC—31—97 BENJAM SURFACE TREATMENTS— FREE—MACHING BRASS— APCI-15 SURFACE TREATMENTS— STAINLESS STEEL ASIM—A240—3 SURFACE TREATMENTS— STAINLESS STEEL ASIM—A240—3 SURFACE TREATMENTS— RED—BRASS—PIPE ASIM—B43 A
                                                                                                  STAINLESS STEEL ASTM-A403-W
STAINLESS STEEL ASIM-A194-8
COPPER-PIPE ASIM-B42 APCI
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NYLCN-SEAT USED IN K-G REGULATOR- IGNITION-TEMPERATURE IN 100-PERCENT OXYGE

NYLCN-SEAT USED IN K-G REGULATOR- IGNITION-TEMPERATURE IN 100-PERCENT OXYGE

OPERATIONAL-HAZARDS- DISPOSAL OF VENTED GASES COMPANY PRACTICES APCI

OPERATIONAL-HAZARDS- DISPOSAL OF VENTED GASES COMPANY PRACTICES APCI

OPERATIONAL-HAZARDS- COUPLING TO UTHER SYSTEMS APCI-III-1 APCI-IIIC2-1

OPERATIONAL-HAZARDS- OVERPRESSURE APCI-IIA-1 2P 2/18/72

OPERATIONAL-HAZARDS- STILLS AND LEAKAGE SEPARATION OF INCOMPATIBLE MATERIALS

OPERATIONAL-HAZARDS- OVERPRESSURE INTEGRITY OF INSULATION FIELD FABRICATED

UPERATIONAL-HAZARDS- OVERPRESSURE INTEGRITY OF INSULATION FIELD FABRICATED

OPERATIONAL-HAZARDS- STILLS AND LEAKAGE APCI-IID-1 2P 9/3/71
                               STAINLESS STEELS-TYPE-416-C
STAINLESS STEEL-TYPE-304 UN
                  CARBON STEEL- NON-OXYGEN SE
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                                                                                                                                                    TAKSET PITTSBURGH CHEMICAL
ALUMINUM ASTM-BZ09-5083-0
COPPER-SILICON ASTM-B98GRB
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MISTY PROBLEM VAPOR-CLOUDS FROM DEFROST UPERATIONS ALLEGEDLY CAUSED HIGHWAY
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12/10/71 1P
                                                                    PLASITE-NO-7122H WISCONSIN
                                                                                     ALUMINUM ASTM-8211-2024-T4
                                                                                                                                                                                                        TREATMENTS- ALUMINUM ASTM-B247-6061-T6
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                                                                                                                                                                                                                                                                                                                                                                                 SOLDERS, AND SURFACE TREATMENTS- COPPER-TUBE ASTM-875
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 BRASS-SHEET OR
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NEAK-MISS ACCIDENT- CREIGHTUN APCI-MEMO-68 06/4/68
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                                           OPERATIONAL-HAZAROS- CONTAMINANTS ACUUMULATION APCI-IIE-1 1P 7/21/71
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                                           OPERATIONAL-HAZARDS- OXYGEN-TRANSFER PRODUCTION TO STORAGE, STORAGE TO SYST
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                                    +APC I
                                           OPERATIONS DEPARTMENT PREVENTIVE MAINTENANCE REPORT FEED-BACK-CARD FORM-361
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                        MASTER . H. H. +APCI
                                           OPERATIONS HEARING PROTECTION PROGRAM APCI-MEMO-71 04/7/71 2P PLUS 1P
                                           OPERATIONS SAFETY MANUAL APCI-SAFETY MANUAL-20P64 88P 1964 (OUT OF PR
990003300
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                          BROPHY . M. +APCI
                                           OXYGEN COMPATABILITY TESTS- MOLYLUBE-KOTE-AR AND MOLYLUBE-N APCI-RED-NOTE
990001110
                          DINAN,E. +APCI
                                           DXYGEN COMPATIBILITY TESTS FOR VARIOUS MATERIALS- ABMA THREAD LUBRICANT AND
990002600
                          BALL . W.L. +APCI
                                           OXYGEN COMPRESSOR FIRE APCI-SAFETY-GRAM-NO-03 2P 7/7/61
990002430
                                           OXYGEN CONTROL-PANEL APCI-DES-ENG-STD-534.1 (TO BE PUBLISHED)
                                    +APCI
990000050
                                           UXYGEN CYLINDER FAILURE APCI-SAFETY-GRAM-NO-13 2P 6/1/62
                      SCHMOYER, W. W. +APCI
990002730
                        MASTER, H. H. + APCI
                                           UXYGEN FLOW-METER RING SEAL-FLUID APCI-MEMO-70 02/27/70 1P
990003120 EDERICK, L.G. LATSHAW, D.R. +APCI
                                           DXYGEN COMPATABILITY WITH TWO-PART EPOXY-COMPOUND (7343-RESIN- 7139-CATAL
990005000
              LAPIN.A. FOSTER.R.H. +APCI
                                           DXYGEN DIFFUSION IN THE ATMOSPHERE FROM LIQUID DXYGEN POOLS
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              LAPIN. A. FOSTER, R. H. +APCI
                                                 DIFFUSION IN THE ATMOSPHERE FROM LIQUID GXYGEN POOLS
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990003060 EDERICK, L.G. LATSHAW, D.R. +APCI
                                           OXYGEN
                                                 INDEX RATING SILICONE-O-RING (1/8-INCH DIA) APCI-1WO-NO-XD-0128
990003040 EDERICK, L.G. LATSHAW, D.R. +APCI
                                           OXYGEN INDEX RATING VITON-O-RING MATERIAL- VITON-E-60 (GREEN) VITON-A (8
990002640
                        MASTER, H. H. +APC (
                                           OXYGEN PIPE-LINE FAILURE APCI-MEMO-67 12/29/67 1P
990002340
                                           DXYGEN PUMP FILTER ASSEMBLY APCI-DRAWING-58521C REV-B 12/18/57
990000140
                      SCHMOYER, W. W. +APCI
                                           OXYGEN REGULATORS IN THE WELDING INDUSTRY ... APCI-SAFETY-GRAM-NO-60C 5P 11/
990002170
                       LATSHAW.D.R. +APCI
                                           OXYGEN SAFETY REVIEW CHECK-LIST APCI-MEMO-71 05/4/71 3P
990003130 EDERICK, L.G. LATSHAW, D.R. +APCI
                                           UXY-TITE THREAD COMPOUND APCI INO-NO-XD-0134 APCI-ANAL-REP-71-336 IP 1
990002670
                      STUMPLER. R. D. +APCI
                                           PAUL. CARTER. AND COSMODYNE LOX-PUMP SAFETY APCI-MEMO-71 1/01/26/71 2P
990001040
                                           PERSONAL PROTECTION-EQUIPMENT MAINTENANCE APCI-PDM-1.12 7P 4/21/67
                                          PERSONNEL-PROTECTIVE SHIELDS FOR OXYGEN SYSTEMS APC1-TB-42 3P 9/30/71
990003280
                         SMITH . H. W. +APCI
                                          PERSONNEL-PROTECTIVE-EQUIPMENT- EYE PROTECTION APCI-SAFETY-STD-627.4.2 5
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                                          PERSONNEL-PROTECTIVE-EQUIPMENT- WEARING APPAREL HARD HATS APCI-SAFETY-ST
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                                          PERSONNEL-PROTECTIVE-EQUIPMENT ALUMINIZED HEAT PROTECTIVE CLOTHING APCI-S
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                         SMITH . H . W . + APC I
                                          PERSONNEL-PROTECTIVE-EQUIPMENT- RESPIRATORY PROTECTIVE EQUIPMENT APCI-SA
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                                          PERSONNEL-PROTECTIVE-EQUIPMENT TONNAGE AIR-SEPARATION PLANT APCI-SAFETY-S
990001480
                          BROPHY, M. +APCI
                                          PIPE BURNING TESTS APCI-R+D-NOTEBOOK-111 P26-9 4P 4/17/61
                    HIMMELBERGER.F. *APCI
                                          PIPING- APPROVED PIPE THREAD SEALANTS APCI-CES-ENG-STD-570.5.1 IP 11/11/
990001180
990000300
                                          PIPING- DRY DXYGEN SERVICE -20F TO 100F 150-PSIG-MAX CARBON-STEEL
990000310
                                    +APCI PIPING- DRY DXYGEN SERVICE -20F TO 100F 275-PSIG-MAX CARBON-STEEL
990000320
                                    +APCI PIPING- DRY DXYGEN SERVICE -20F TO
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                                                                                     500-PSIG-MAX-OWG CARBON-STEEL
990000330
                                    *APCI PIPING- DRY UXYGEN SERVICE -20F TO
                                                                               100F 720-PSIG-MAX CARBON-STEEL
990000350
                                   +APCI PIPING- EXTENDED BONNET VALVE CODE
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                                    +APCI PIPING- INTRODUCTION HAND VALVE-CODE APCI-DES-ENG-STD-579.3 12P 1/63
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PIPING- DXYGEN COMPRESSOR SYSTEM APCI UPERATED APCI-DES-ENG-STD-570.7
PIPING- OXYGEN-PIPING APCI-UES-ENG-STD-578.60.1 14P 4/24/72
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990000120
                       SCHMÜYER, W.W. +APCI
                                           PRESSURE GAUGE FAILURES APCI-SAFETY-GRAM-NO-43 2P 5/8/64
990003170
                                     +APCI
                                           PRESSURE-GAUGE FAILURE SAFETY GLASSES SAVE ANOTHER PAIR OF EYES APCI-SAFE
990000160
                                     +APCI
                                           PRESSURE-VESSELS- GASEOUS OXYGEN STORAGE CYLINDER: APCI-DES-ENG-STD-515.1.3
990000210
                                           PRESSURE-VESSELS- HEAD-DESIGN APCI-DES-ENG-STD-510.3 13P 8/62
990000190
                                           PRESSURE-VESSELS- MATERIALS OF CONSTRUCTION APCI-DES-ENG-STD-510.1.4 4P
990000200
                                           PRESSURE-VESSELS- SHELL-DESIGN APCI-DES-ENG-STD-510.2 4P 2/65
9900001 80
                                            PRESSURE-VESSELS- VESSEL-DESIGN-BASIS AND GENERAL STANDARDS APCI-DES-ENG-S
990000150
                                    +APCI
                                           PRESSURE-VESSELS- VAPORIZER AND CRYOGENIC LIQUID DISPOSAL APCI-DES-ENG-STD
990001310
                                     +APC I
                                           PROCEDURE TO ESTABLISH ACCEPTANCE OF FIBERIZED MINERAL WOOL INSULATION AP
990002870
                                            PRODUCT TEST PROCEDURES 1200-SERIES REGULATORS APCI-TEST-PROCEDURE 4P 1/
                                     +APC I
990002510
                                            PRODUCT VAPOR HAZARDS- SAFETY INFORMATION RELATIVE TO LIQUID-VAPOR-CLOUDS
                         MASTER, H. H. +APCI
990001470
                          BASSLER, E. +APCI
                                            PRODUCTION OF ROCK WOOL BETHLEHEM-STEEL-CO APCI-MEMO-59 11/12/59 2P
990001120
                           ENT, W.L. +APCI
                                            PUTTI-ROPE: ANALYSIS FOR OIL CONTENT AND FLAMMABILITY. TEMPERATURE
990002230
                                     +APCI
                                            QUALITY CONTROL PROGRAM APCI-DIST-OPER-MAN-6.3 6P 7/65 1/69 4/68 PLU
990001450
                     HIMMELBERGER.F. +APCI
                                            QUALITY CONTROL OF ROCK WOOL APCI-MEND 2 HIMMELBERGER, F. APCI QUALITY
                                           QUALITY CONTROL OF ROCK WOOL APCI-MEMO-59 11/6/59 2P
990001450 1-MEMO 2 HIMMELBERGER.F. +APCI
990001190
                       SCHMOYER, W. W. +APCI
                                           REGULATOR THREAD SEALANT MOLYLUBE-N APCI-MEMO-63 10/4/63 IP
990002010
                          WALDE . R. A. +APCI
                                            RELATIONSHIP OF THE CHEMICAL STRUCTURE OF CUTTING OILS TO THEIR OXYGEN-COMPA
990002610
                          BALL . W.L. +APCI
                                            REPORT OF DXYGEN PUMP EXPLOSION AIRCO-BUTLER APCI-MEMO-63 10/21/63 1P PL
990000880
                                    +APC I
                                           REQUIREMENTS FOR IPD SPECIFIED PAINT SYSTEMS APCI-QUAL-CONT-LAYOUT-120F
990000830
                                    +APC I
                                           REQUIREMENTS FOR VENDOR CLASS-B CLEANING APCI-QUAL-CONT-LAYOUT-114F 2P 7
990000860
                                    *APC I
                                           REQUIREMENTS FOR VENDOR CLASS-AAA CLEANING APCI-QUAL-CONT-LAYOUT-117F 3P
990000850
                                     +APC I
                                           REQUIREMENTS FOR VENDOR CLASS-AA CLEANING APCI-QUAL-CONT-LAYOUT-116F 2P
990000840
                                     +APC I
                                           REQUIREMENTS FOR VENDOR CLASS-A CLEANING - APCI-QUAL-CONT-LAYOUT-115F 2P 7
990002250
                           ENT, W.L. +APCI
                                           REVISIONS TO IGO QUALITY ASSURANCE PROGRAM COST-PROCEDURES DIST-OPER-MAN-V
990003140
                        KITSON, F.K. +APCI
                                           RUPTURE DISCS MANUFACTURED LOX TANKERS BY AMETEK APCI-MEMO-71 06/22/71
990002830
                                           SAFE HANDLING OF CRYOGENIC LIQUIDS AND ASSOCIATED EQUIPMENT APCI-POM-SEC-
990002700
                       SCHMUYER, W.W. +APCI
                                           SAFE HANDLING OF REGULATORS AND TORCHES APCI-PAPER 17P PLUS 2P ATTACHME
990003180
                          SMITH.H.W. +APCI
                                           SAFETY EQUIPMENT NEVER PREVENTS AN ACCIDENT- IT ONLY PREVENTS AN INJURY
990000530
                                    +APCI
                                           SAFETY CONTROL PROCEDURES- EMERGENCY PROCEDURES APCI-SAFETY-STD-626.3.8
990002400
                                    +APCI
                                           SAFETY CONTROL PROCEDURES-PURGING METHODS APCI-SAFETY-STD-626.4.1 7P 1/
990002090
                          SMITH. H. W. +APCI
                                           SAFETY CONTROL PROCEDURES- AIR-SEPARATION-PLANT SAFETY WORK PERMITS APC
990002080
                          SMITH.H.W. +APCI
                                           SAFETY CONTROL PROCEDURES- TAG OUT PROCEDURE APCI-SAFETY-STD-626.3.3 2P
990002030
                                           SAFETY CONTROL PROCEDURE- SAFETY WORK-PERMIT APCI-POM-SEC-1.04 3P PLUS
                                    +APCI
990002020
                                           SAFETY CONTROL PROCEDURE- TAG OUT APCI-POM-SEC-1.03 2P PLUS EXHIBIT-A
990003460
                                           SAFETY RELIEF VALVES LOCATION AND PIPING-DESIGN CONSIDERATIONS . APCI PIPIN
990002330
                                    +APC1
                                           SAFETY REPORTS AND FORMS APCI-POM-SEC-5.18 6P PLUS EXHIBITS ABCDEFGH 3/
990001350
                          BRUPHY . M. +APCI
                                           SAFETY TESTS UNDER WO-81-0095 HYLOMAR-UNIVERSAL-JOINTING COMPOUND SQ-32 AND
                        MOYSAN, S.R. +APCI
990001210
                                           SAFETY-VALVE-SEAT OXOMAT FLAMMABILITY IN 100-PERCENT GASEOUS OXYGEN APCI
990002300
                                    +APCI
                                           SAFETY-VALVES AND RUPTURE-DISCS APCI-PUM-SEC-6.02 19P INCLUDING EXHIBITS
990000590
                           KEHAT, E. +APCI
                                           SAFETY, HAZARDS, AND EXPLOSION TESTING- UCON-TYPE LUBRICANTS, STEEL-PIPES
990000600
                           KEHAT, E. +APCI
                                           SAFETY, HAZARDS, AND EXPLOSION TESTING- STANDARD PRESSURE BOMBS AND SPARK-IG
                        FUSTER, R. H. +APCI
990000690
                                           SAFETY, HAZARDS, AND EXPLOSION TESTING- HOUDRY FOAM INSULATION, AND HAVEG GL
                        FUSTER, R. H. +APCI
                                           SAFETY, HAZARDS, AND EXPLUSION TESTING- IGNITION TEST-APPARATUS, FLORUBE-GRE
990000660
990000670
                        FUSTER . R. H. +APCI
                                           SAFETY, HAZARDS, AND EXPLOSION TESTING- POLYESTER RESIN IMPREGNATED FIBERGL
990000700
                        FOSTER, R. H. +APCI
                                           SAFETY, HAZARDS, AND EXPLOSION TESTING- TALCUM-POWDER AS A LUBRICANT, TARSET
                           KEHAT . E. +APCI
                                           SAFETY: HAZARDS, AND EXPLOSION-TESTING- CS2 CARBON-DISULFIDE ALIQUIPPA PUMP-
990000640
                           KEHAT, E. +APCI
                                           SAFETY, HAZARDS, AND EXPLOSION TESTING- PINE AND MAPLE WOOD, ACTIVATED CARBO
990000620
                           KEHAT . E. +APCI
990000630
                                           SAFETY, HAZARDS, AND EXPLOSION TESTING- SILICON-DILS DOW-CORNING-RF-1-0065,
                                           SAFETY: HAZARDS: AND EXPLOSION TESTING - SPARK-IGNITION: STANDARD BOMB TEST:
990000610
                           KEHAT .E. +APCI
990000580
                        FUSTER , R. H. + APCI
                                           SAFETY, HAZARDS, AND EXPLOSION TESTING- EPON-H-60, POLYCEL-440R, AND STYROFO
990000650
              KEHAT, E. FOSTER, R. H. +APCI
                                           SAFETY, HAZARDS, AND EXPLOSION TESTING- STANDARD IGNITION TEST METHOD, APL P
990004560
                                           SEALANTS AND THREADING COMPOUNDS- OXOMAT APCI-1424-10 - 1P 2/21/72
990004510
                                    +APCI SEALANTS AND THREADING COMPOUNDS- MOLYLUBE-N BEL-RAY CO FARMINGDALE/NJ
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PCI SYSTEM-EMERGENCIES WARNING DEVICES ADCI-1V8-1 SP 11/12/71

SYSTEM-EMERGENCIES WARNING DEVICES ADCI-1V8-1 SP 11/12/71

SYSTEM-EMERGENCIES HAZAROS PROTECTION GENERAL PRECAUTIONS APCI-1VE-1 2P

SYSTEM-EMERGENCIES SAFETY TRAINING AND AREA PLACARDING APCI-1VA-1 4P

SYSTEM-EMERGENCIES PROTECTION PROSONNEL APCI-1VC1-1 6P 1/13/72

PCI SYSTEM-EMERGENCIES PROTECTION PRESONNEL APCI-1VC1-1 6P 1/13/72

PCI TARE-SEAL THREAD LUBRICANT AND SEALER- TAPE-SEAL FROM FRIESLAND-PLASTIC COMPCI TARE-SEAL THREAD LUBRICANT AND SEALER- TAPE-SEAL FROM FRIESLAND-PLASTIC COMPCI TARE-SEAL THREAD LUBRICANT AND SEALER- TAPE-SEAL FROM FRIESLAND-PLASTIC COMPCI TELEPHONE CONVERSATION WITH MR WILLIAM MCCORMINANTS AND FLUGRESCENCE DAMCO-TELEPHONE CONVERSATION WITH MR WALLIAM MCCORMINCK REGARDING REQUIREMENTS FOR TELEPHONE CONVERSATION BE USED IN OXYGEN COMPRESSOR SUCTION APCI-MED-71

PCI TESTING OF SCREENS TO BE USED IN OXYGEN COMPRESSOR SUCTION APCI-MED-71

TESTING OF SCREENS TO BE USED IN OXYGEN COMPRESSOR SUCTION APCI-MED-71

THERMAL AND ELECTRICAL INSULATIONS— MINERAL-WOOL APCI-1A3A-05 IP 2/21/72

PCI THERMAL AND ELECTRICAL INSULATIONS— TRANSITE, JOHNS-MANVILLE APCI-1A3A-07

THERMAL AND ELECTRICAL INSULATIONS— TRANSITE, JOHNS-MANVILLE APCI-1A3A-03 IP S/21/72

THERMAL AND ELECTRICAL INSULATIONS— TRANSITE, JOHNS-MANVILLE APCI-1A3A-03 IP S/21/72

THERMAL AND ELECTRICAL INSULATIONS— GLASS-WOOL APCI-1A3A-03 IP S/21/72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             ROBERTS, R. LEHIGH UNIV FATIGUE CRACK GROWTH-RATES AND FRACTURE TOUGHNESS ACCEPTANCE TEST FOR CLASS-B CLEANLINESS APL-ENGR-SPEC-A-01 2P 5/12/69 ACCEPTANCE TEST FOR CLASS-AA CLEANLINESS (OXYGEN-CLEAN) APL-ENGR-SPEC-A.03 ACCEPTANCE TESTS FOR CLASS-A CLEANING APL-ENGR-SPEC-A.02 3P 5/12/69
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       5/5
                                                                                                                                                                                                                                                                                                             APCI-IA2A-01 1P 2/21/72
DCARBON-TAPE APCI-IA2A-06
                                                                                                                                                                                                                                                                                                                                                                                                                             SET-UP AND OPERATING INSTRUCTIONS FOR AIR-PRODUCTS REDI-SET WELDING AND CUTT SNIFF THOSE CYLINDERS BEFORE REFILLING APCI-SAFETY-GRAM-NO-31 2P 8/21/63
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     INSULATIONS- NATIONAL-GYPSUM-BLUE NATIONAL-GYPSUM CO
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AUTOIGNITION TEST APCI-ANAL-REP-61-683 APCI-IWO-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        APCI-MEMO-64 04
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                                                                                                                                                                                                                                                                                                                                                                                              SEALING MATERIALS- FLAMMABILITY IN 100-PERCENT GASEOUS DXYGEN FDAMSEAL-30
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           APCI-SAFETY-S
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  STAFFING AND CHECK-IN SYSTEMS FOR OPERATING-PLANTS APCI-MEMO-68 06/25, STANDARD SPECIFICATION FOR A FIELD-FABRICATED CRYOGENIC LIQUID STORAGE-TANK STORAGE TANK CLEANING APCI-MEMO-63 01/24/63 IP SUMMARY OF ACTION TAKEN ON PRESSURE-GAUGES APCI-MEMO-61 08/2/61 4P SYSTEM-EMERGENCIES PROTECTION BUILDINGS AND ADJACENT SYSTEMS PROTECTION
SEALANTS AND THREADING COMPOUNDS- DAMCO TAPE APCI-IA2A-07..2P 2/21/72
SEALANTS AND THREADING COMPOUNDS- CKANE PACKING CO-TAPE APCI-IA2A-09 2
SEALANTS AND THREADING COMPOUNDS- T-FILM ECO MFGR CO APCI-IA2A-03 1P
SEALANTS AND THREADING COMPOUNDS- SANDEN TAPE APCI-IA2A-08 2P 2/21/72
SEALANTS AND THREADING COMPOUNDS- PUTTI-ROPE NATIONAL GREENHOUSE CO APC
SEALANTS AND THREADING COMPOUNDS- THREE—M FLUGROCARBON-TAPE APCI-IA2A-01
SEALANTS AND THREADING COMPOUNDS- TELLORE PERMACEL APCI-IA2A-02 2P
SEALANTS AND THREADING COMPOUNDS- PERMATEX-1516 APCI-IA2A-02 2P
SEALANTS AND THREADING COMPOUNDS- PERMATEX-1516 APCI-IA2A-01 1P 2/21/72
SEALANTS AND THREADING COMPOUNDS- CROSSLITE-FLUGROCARBON-TAPE APCI-IA2A-01 APCI
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SNIFF THUSE CYLINDERS BEFORE REFILLING APCI-SAFETY-GRAM-NO-
SOLVENT AND CLEANERS- DEVIATIONS CLEANING FOR OXYGEN SERVICE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               VALVE MASHERS NEW AND USED QUALITATIVE AND QUANTITATIVE OIL
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WEAK SAFETY SHOES APCI-SAFETY-GRAM-NO-11 2P 5/14/62
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             SPECIALTY-GAS GAUGE-FAILURE APC1-MEMO-64 04/13/64 4P STAFFING AND CHECK-IN SYSTEMS FOR OPERATING-PLANTS A
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            T-FILM THREAD COMPOUND, AUTOIGNITION TEST USE OF PERLITE IN AIR-SEPARATION COLD-BOXES
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EVERSON, I.
EVERSON, I.
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990001270
               KEY.C.F. RIEHL.W.A. +NASA-HUNTSVILLE COMPATIBILITY OF MATERIALS WITH LIQUID OXYGEN NASA-TMX-985 72P
                           KEY.C.F. *NASA-HUNTSVILLE COMPATIBILITY OF MATERIALS WITH LIQUID DXYGEN III NASA-TMX-5353
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                           KEY.C.F. +NASA-HUNTSVILLE COMPATIBILITY OF MATERIALS WITH LIQUID DXYGEN IV NASA-TMX-53773
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990001240
                           KEY.C.F. +NASA-HUNTSVILLE COMPATIBILITY OF MATERIALS WITH LIQUID CXYGEN NASA-TMX-53052 3
                         GAYLE, J.B. +NASA-KENNEDY FIRE INCIDENT IN AN OXYGEN CLUUD FIRE JOURNAL PP76-8 AND 81 4P
990002520
990005970
                         BRYAN, C.J. +NASA-KENNEDY MATERIALS COMPATIBILITY FOR GASEOUS DXYGEN SYSTEMS MAB-3268-69 9
                                    +NATIONAL BOARD OF BUILER AND PRESSURE VESSEL INSPECTORS NATIONAL BOARD INSP
990002120
                        PINNEY, G.G. +NATIONAL CYLINDER GAS CO OXYGEN TRAILER FIRE AICHE-CEP-TECH-MANUAL SAFETY I
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                                    +NATIONAL FIRE PREVENTION ASSOC STANDARD FOR THE INSTALLATION AND OPERATION OF
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                                   +OFFICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE +OFFICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE
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                                   +OFFICE OF PIPELINE SAFETY MINIMUM FEDERAL SAFETY-STANDARDS FOR GAS PIPELINES CO
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+OFFICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE +OFFICE UF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE +PENNSALT CORP CLEANING OF LIQUIFFIED-GAS PROCESSING EQUIPMENT PENNSALT-TECHNICA DENISON,D.M. +RAF INSTITUTE OF AVIATION MEDICINE FARNBOROUGH HANTS ENGLAND ASSESSMENT OF T DENISON,D. +RAF INSTITUTE OF AVIATION MEDICINE FARNBOROUGH HANTS ENGLAND FURTHER STUDIES DENISON,D. +RAF INSTITUTE OF AVIATION MEDICINE FARNBOROUGH HANTS ENGLAND FIRE RISKS TO NIHART,G.J. ET.AL +UNION CARBIDE CORP COMPATIBILITY OF MATERIALS WITH 7500-PSI OXYGEN ADGORAGO			+0FF1(ā	EL INF	SAFFTY	TRANSPUR	TATION OF	NATURAL	AND D1	LHED	CACA	V OTOEL INC	
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990001110 TS FOR VARIOUS MATERIALS- ABMA THREAD LUBRICANT AND SEALANT, ANDEROL-L-536 RUST-PREVENTIVE LEHIGH CHEMICAL C
                               APL ACCEPTANCE TEST FOR CLASS-8 CLEANLINESS APL-ENGR-SPEC-A-01 2P 5/12/69
990003600
                  PEGRAM, J. W. APL ACCEPTANCE TEST FOR CLASS-AA CLEANLINESS (GXYGEN-CLEAN) APL-ENGR-SPEC-A.03 4P
990003620
990003610
                  PEGRAM.J.W. APL ACCEPTANCE TESTS FOR CLASS-A CLEANING APL-ENGR-SPEC-A.02 3P 5/12/69
990003630 GRAM, J. W. APL DEGREASING ACCEPTANCE TESTS FOR DXYGEN SERVICE COMPRESSORS APL-ENGR-SPEC-K. 02 3P 6/23/69
990000620 TING- PINE AND MAPLE WOOD, ACTIVATED CARBON APCI-MAR-87-0-8821 1P 10/61
990005550 UNAL-HAZARDS- CONTAMINANTS ACUUMULATION APCI-IIE-1 1P 7/21/71
990004670 PLASTICS, ELASTOMERS, AND ADHESIVES- KEENE-BINDER APC1-IA4A-02 1P 2/21/72
990004680 PLASTICS, ELASTOMERS, AND ADHESIVES- KEL-F-81 APCI-1A4A-03 1P 2/21/72 990004700 PLASTICS, ELASTOMERS, AND ADHESIVES- NEOPRENE APCI-1A4A-05 1P 2/21/72
990004690 PLASTICS, ELASTOMERS, AND ADHESIVES- NYLON APCI-1A4A-04 1P 2/21/72
990004720 PLASTICS, ELASTOMERS, AND ADHESIVES- NYLON-66 ICI LTD/UK APCI-144A-07 1P 2/21/72
990004660 PLASTICS, ELASTOMERS, AND ADHESIVES- RTV-60, SILICONE-RUBBER COMPOUND WITH SS-4004-SILICONE-PRIMER GE THERMOL
990004710 PLASTICS, ELASTOMERS, AND ADHESIVES- VITON-A DUPONT APCI-IA4A-06 1P 2/21/72
990005800 ERAL CONSIDERATIONS OF THE AGING SYSTEM APC1-111A5-1 1P 8/22/71
990002950 CAL INDUSTRIES SAFETY IN AIR AND AMMONIA PLANTS AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS
990000950 NSPECTION FOR EQUIPMENT IN AIR PLANTS AND IN OXYGEN SERVICE APCI-POM-SEC-1.08 7P PLUS 3P ATTACHMENTS 4/4/
9900C2610 T OF DXYGEN PUMP EXPLOSION AIRCC-BUTLER APCI-MEMO-63 10/21/63 1P PLUS 6P ATTACHMENTS
                    LANG.A. LINDE AIR-FRACTIONATION PLANT EXPLOSION AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMO
99000770 CLEANING REQUIREMENTS FOR AIR-PLANT EQUIPMENT APCI-QUAL-CONT-LAYOUT-101F 2P PLUS 5P OF ATTCHMTS 7/1/71
990002890 OPERATING INSTRUCTIONS FOR AIR-PRODUCTS REDI-SET WELDING AND CUTTING OUTFITS APCI-BROCHURE 11P 9/25/69
990000420 APCI PLANT-SITE CRITERIA- AIR-SEPARATION APCI-SAFETY-STD-605.1 9P 11/10/60
            APCI USE OF PERLITE IN AIR-SEPARATION COLD-BOXES APCI-TB-39 1P 6/14/71
99003070 W.L. APCI MINUTES OF CGA AIR-SEPARATION EQUIPMENT COMMITTEE HELD AT FT/LAUDERDALE FLORIDA 5/11-12/71 LIQ
990003340 UTECTIVE-EQUIPMENT TONNAGE AIR-SEPARATION PLANT APCI-SAFETY-STD-627.5.1 4P 6/15/70
99000261A AIRCO DESCRIPTION OF AN AIR-SEPARATION PLANT EXPLOSION AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONI
990000430 BALL, H.L. APCI CRITERIA9 AIR-SEPARATION PLANT-LAYOUT APCI-SAFETY-STD-605.1.3 6P 1/6/61
990000520 LL, W. L. APCI CHECK-LIST- AIR-SEPARATION PLANT-SITE APCI-SAFETY-STD-610.1.1 5P 11/28/60
            APCI PLANT COMPONENTS- AIR-SEPARATION PLANT, CRYOGENIC-LIQUID, AND DISPOSAL APCI-SAFETY-STD-607.1.20 3P
990000470
            APCI PLANT COMPONENTS - AIR-SEPARATION PLANT, PIPING, VALVES AND SAFETY-RELIEF DEVICES APCI-SAFETY-STD-60
990000460
                 MASTER.H.A. APCI AIR-SEPAKATION-PLANT CONTAMINATION- HISTORY, SAMPLING, AND ANALYSIS APCI PLANT
990000970
990002090 AFETY CONTROL PROCEDURES- AIR-SEPARATION-PLANT SAFETY WORK PERMITS APCI-SAFETY-STD-626.3.5 3P 6/19/61
            APCI PLANT COMPONENTS- AIR-SEPARATION, UXYGEN, COMPRESSOR APCI-SAFETY-STD-607.1.2.3 6P 12/62
99000396C -FUEL-BURNER EQUIPMENT AT ALCAN-BOOTH ALUMINIUM WORKS ROGERSTONE/NEWPORT 5/18/71 APL-SAFETY-DEPT-REP-37
990001070 TONATION TESTS OF GIL FROM ALIQUIPPA PUMP-SUCTION FILTER DEFROST AND OF METHYLENE-CHLORIDE APCI-MEMO-61 12/
990000640 TING- CS2 CARBON-DISULFIDE ALIQUIPPA PUMP-SUCTION-FILTER-DEFROST CYL-SEAL SEALING COMPOUND APCI-MAR-87-0-882
990003570 ON OR REVISION OF MAXIMUM ALLOWABLE OPERATING PRESSURE FEDERAL REGISTER VOL-36 NO-176 9/10/71
990000040 ITSON, F.K. APCI APPROVED ALLOY STRELS IN CRYOGENIC SERVICE APCI-SAFETY-GRAM-NO-10-REV-1 1P 10/25/63
990002160 S STUDY OF WELDED ALUMINUM ALLOY-5083 ASME WINTER ANNUAL-MEETING NEW/YORK 8P 11/29/70-12/3/70
990001540 RACTERISTICS OF METALS AND ALLOYS ARS JOURNAL P917-23 7P 7/61
                     APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- CARBON STEEL- NON-OXYGEN SERVICE WITH POSS
990005190
                      APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- MUNTZ-METAL 60-40-TYPE COMPOSITION CU-5
990005230
                      APCI METALS, ALLOYS, SCLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A351-GR-CF8 APCI-1A
990005160
                      APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALPHA BRASS-TYPE TCL-100 OR DTD-5019 TUNGU
990005240
                      APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- SHPEROIDAL-GRAPHITE IRON CONTINENTAL-STAND
990005200
                      APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- BRASS-SHEET OR PLATE ASTM-836 APCI-1A6A
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AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AZGG9—304

AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AZGG9—304

AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AL94—8T321

AND SURFACE TREATMENTS—ALUMINUM ASTM—BZ41—6061—T6

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AND SURFACE TREATMENTS—ALUMINUM ASTM—BZ1—Z0Z4—T4

AND SURFACE TREATMENTS—CARBON STEEL (OXYGEN SERVICE) APCI—IA6A—07

AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—B43

AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—B43

AND SURFACE TREATMENTS—FREE—MACHING BRASS—APCI—IA6A—27

AND SURFACE TREATMENTS—FREE—MACHING BRASS APCI—IA6A—27

AND SURFACE TREATMENTS—FREE—MACHING BRASS APCI—IA6A—26

AND SURFACE TREATMENTS—FREE—MACHING BRASS APCI—IA6A—05

AND SURFACE TREATMENTS—FREE—MACHING BRASS APCI—IA6A—05

AND SURFACE TREATMENTS—FREE—MACHING BRASS APCI—IA6A—06

AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—B3CONSIN PROTECTIVE CO
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                      SILVER APCI-IA6A-35 1P 2/21/72
NOVONOX STAINLESS STEEL ALLOY TO DIN GERM
STAINLESS 9-PERCENT NICKEL STEEL ASIM-A35
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ALUMINUM ALLOY-5083 ASME WINIER ANNUAL-MEETING NEW/YORK 8P 11/29/70-12/3/70
ALUMINUM ASTM-82/09-5083-0 APCI-1A6A-09 2P 2/21/72
ALUMINUM ASTM-B210-6061-T6 APCI-1A6A-07 2P 2/21/72
ALUMINUM ASTM-B211-2024-T4 APCI-1A6A-07 2P 2/21/72
ALUMINUM ASTM-B211-2024-T4 APCI-1A6A-11 2P 2/21/72
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ALUMINIZED HEAT PRUTECTIVE CLOTHING. APCI-SAFETY-STD-627.44.7 2P 5/68
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APC I-146A-29
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APCI-DES-ENG-STD-571.4 3P 11/67
APCI-DES-ENG-STD-571.2 3P 11/67
APCI-DES-ENG-STD-571.3 4P 11/67
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ALUMINUM TO STAINLESS-STEEL APCI-DES-ENG-STO-579,15 2P 9/66
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ANDEROLL-536 RUST-PREVENTIVE LEHIGH CHEATON TEST CONTROLL STONE AND CASCELL STONE AND CASCEL 990001890 RUBBER, IRON-UXIDES, TALC, ASBESTOS, ALUMINUM-CHIPS, STEEL-WOOL, MAGNESIUM-CHIPS, MAGNESIUM-SHEET, DYE-PENETRA 990003450 COMPRESSED GAS ASSOC ASSEMBLY OF INDUSTRIAL PRACTICES USED FOR GASEGUS OXYGEN TRANSMISSION AND DISTRIBU 990001100 KITSON,F.K. APCI ASSEMBLY OF OXYGEN REGULATORS T-FILM APCI-MEMO-61 11/30/61 1P APCI-IWD-NO-LB-0795 APCI-ANAL 06/2/71 IP PLUS 2P ATTACHMENT ATTACHMENT PLANTS V-2 AMOCO-H-100, PENTON, I-FILM-THREAD COMPOUND APCI-MAR-87-0-8821 1P 11/61 AMOCO-L-10, INDOPOL-PULYBUTENE-DIL AMOCO-H-100, PENTON, T-FILM-THREAD COMPOUND 3/70 APCI-MEMO-60 09/30/60 ANALYSES REGUIRED ON QUALITY-CONTROL-SAMPLES APCI-MEMO-68 05/1/68 APCI-DIST-OPER-MAN-V-1-SEC-6.32 7P AMMONIA AMENDMENTS TO NFPA-NO-566 3P PASSED 5/71 APC1-1464-21 2P 2/21/72 AIR AND 2P 2/21/72 APCI-MAR-87-0-8821 1P 2/62 11/1/68 2 p ASBESTOS-PACKING TEFLON COATED ASBESTOS-BLUE APCI-MARD-TI ASPESTOS-PACKING TEFLON COATED ASBESTOS-BLUE AF ASBESTOS-ROPE MATERIAL APCI-MARD-ROTOR ASPERTOR SAFETY IN APC I - I A6A-17 2P 2/21/72 2P 2/21/72 APCI-IA6A-30 2P 2/21/72 ASTM-A182-F-316 APCI-IA6A-21 2P 2/21/72 ASTM-A194-8T321 APCI-IA6A-19 2P 2/21/72 APCI-1A6A-15 2P 2/21/72 APCI-1A6A-18 2P 2/21/72 APCI-1A6A-16 2P 2/21/72 APCI-1A6A-26 2P 2/21/72 ALUMINUM, ASTM-8-210-3003 APCI-1A6A-08 APCI-DES-ENG-STD-571.51 APCI-DES-ENG-STD-571.50 AMETEK APCI-MEMO-71 06/22/71 1P AMMONIA PLANTS AICHE-CEP-TECH-MANUAL APCI-1 A6A-31 2P 2/21/72 APCI-146A-29 2P 2/21/72 ASTM-A182-F-304 AND ASTM-A182-F-316 2/21/72 2/21/72 ASTM-A403-WP304 AND A403-WP304L APC1-1A6A-09 APCI-IA6A-07 APCI-IA6A-11 ANALYSES REQUIREMENTS SUMMARY APCI-1A6A-23 AMENDMENTS PART II ASTM-8210-6061-T6 ASTM-A351-GR-CF8 ASTM-8241-6061-T6 ASTM-8211-2024-T4 ASTM-8247-6061-T6 ASTM-861 UR 862 ASTM-B209-5083-0 ASTM-A312-TP304 ASTM-A320-88304 ASTM-A240-304 ALUMINUM-TUBE ALUMINUM-TUBE ASTM-A269-304 ASTM-A353GB ASTM-898GRB AS1M-B164 **ASTM-875** 990001910 CONSUMER SITES PROPOSED 990003140 ANUFACTURED LOX TANKERS BY 990002950 USTRIES SAFETY IN AIR AND 990000630 10, INDOPOL-POLYBUTENE-CIL 990000630 65, INDOPOL-POLYBUTENE-CIL 990005050 REATMENTS— STAINLESS STEEL 990005020 REATMENTS— STAINLESS STEEL 990005120 REATMENTS— STAINLESS STEEL 990005010 REATMENTS— STAINLESS STEEL 990005040 REATMENTS— STAINLESS STEEL 990005160 REATMENTS— STAINLESS STEEL 990001440 NI IN GRAPHITE IMPREGNATED 990000660 -PACKING, AND IMPREGNATED 990005090 TREATMENTS- COPPER-SILICON BELUW 900-PSIG-MAX-DWG 400-PSIG-MAX-OWG 990004940 S, AND SURFACE TREATMENTS-990001110 EAD LUBRICANT AND SEALANT, 9900005>90 TRANSFER SYSTEMS SYSTEMS-990000650 DARD IGNITION TEST METHOD. 990005900 ENCIES HAZARDS PROTECTION 990005930 T INVESTIGATION AND REPORT 990001130 ELBERGER,F. APCI PIPING-EETING HELD ON BUARD HMS 990003090 ITH OXYGEN JOHNS-MANVILLE 990003100 900 DURABLA JOHNS-MANVILLE 990005070 REATMENTS- STAINLESS STEEL STEEL ASTM-A182-F-304 AND 9-PERCENT NICKEL STEEL 990005030 REATMENTS- STAINLESS STEEL 990004960 RFACE TREATMENTS- ALUMINUM 990004930 RFACE TREATMENTS- ALUMINUM 990004970 RFACE TREATMENTS- ALUMINUM 990004980 RFACE TREATMENTS- ALUMINUM 990005140 NTS- BRASS-SHEET UR PLATE 990004900 CE IREATMENTS- COPPER-PIPE 990003020 LUS NOTES ON VISIT TO HMS 990004950 RFACE TREATMENTS- ALUMINUM 990005130 SURFACE TREATMENTS- BRONZE 990004910 CE TREATMENTS- COPPER-TUBE 990002210 -IPD INSPECTION, REGARDING 990005680 R MALFUNCTION AND FAILURES 990005610 PIPELINE TRANSPORTATION-990004920 TREATMENTS- RED-BRASS-PIPE BROPHY, M.+ SURFACE TREATMENTS- MONEL MARYLAND CASUALTY CO KITSUN, F. K. APCI APCI APCI SCUTT, D.J. MCSWAIN, C.B. ND BELOW 990005170 SS 02000066 990005150 990003020 065100066 990002260 990002090 990002240 990001220 040000066 990003580

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990004940 FACE TREATMENTS- ALUMINUM, ASTM-8-210-3003 APCI-1A6A-08 2P 2/21/72
990001400 0, UCON-HB170, UCON-HB660, AURALUBE-FS, FLUOROLUBE-FS5, KEL-F-LF3, VERSILUBE-F-50, SF81(40)-SILICONE, PYDRAUL-
990002490 MASTER, H. H. APCI AUTO LUAD SYSTEMS APCI-MEMO-71 05/4/71 2P PLUS 3P ATTACHMENTS
990001140 I T-FILM THREAD COMPOUND, AUTOIGNITION TEST APCI-ANAL-REP-61-683 APCI-IWO-NO-80-0068 IP 9/18/61
990002480 MASTER, H. H. APCI LATHROP AUTO-LOAD SYSTEM APCI-MEMO-71 03/22/71 2P PLUS 3P ATTACHMENTS
990004990 RFACE TREATMENTS- ALUMINUM 8361-WP6061-T6 APCI-1868-13 2P 2/21/72
990005660 SPORTATION ROAD, RAILROAD, BARGE AND PIPELINE TRANSPORTATION VIBRATION AND CONTROLLED SLOSHING APCI-11F2E
990005650 SPORTATION ROAD, RAILROAD, BARGE AND PIPELINE TRANSPORTATION VEHICLE ACCIDENT PROCEDURES APCI-11F2D-1 1P
990005640 SPORTATION ROAD, RAILROAD, BARGE AND PIPELINE TRANSPORTATION OXYGEN-DISPERSAL FROM VENTS AND LINES APCI-I
              APCI LUBRICANTS- ESSO BEACON-325 APCI-IA1A-17 1P4 2/21/72
990004510 DING COMPOUNDS- MOLYLUBE-N BEL-RAY" CO. FARMINGDALE/NJ -APCI-IA2A-05 1P 2/21/72
990004400 CI LUBRICANTS- MOLYLUBE-N BEL-RAY CO FARMINGDALE/NJ APCI-IAIA-12 1P 2/21/72
990004880 ENTS- SEALFAS-MASTIC-31-97 BENJAMIN FOSTER CO. APCI-1A6A-02 1P 2/21/72
990005110 S, AND SURFACE TREATMENTS- BERYLLIUM COPPER APCI-1A6A-25:-2P 2/21/72
990001470 I PRODUCTION OF ROCK WOOL BETHLEHEM-STEEL-CO APCI-MEMO-59 11/12/59 2P
990003580 CRYOGENIC TRANSFER-LINES BIBLIOGRAPHY APCI-REPORT P86 2/28/64
990002120 CTION CODE- A MANUAL FOR BOILER AND PRESSURE VESSEL INSPECTORS 150P 1968
990000610 - SPARK-IGNITION, STANDARD BOMB TEST, LED-PLATE-251, PIPE-DOPE - APCI-MAR-87-0-8820 1P 9/61 3 4
990000600 TESTING- STANDARD PRESSURE BOMBS AND SPARK-IGNITION, DOW-CORNING FLUORINATED SILICON-DILS, SHELL POLYURETHANE
              APCI PIPING- EXTENDED BONNET VALVE CODE APCI-DES-ENG-STD-579.4 3P 4/63
990000780 CLEANING REQUIREMENTS FOR BOURDON-TUBE TYPE GAUGES USED FOR DXYGEN SERVICE APCI-QUAL-CONT-LAYOUT-102F 3P
990004130 OGENIC TANKERS BY PUMP AT BRACKNELL APL-IGD-ENGR-MAN-50-02 3P 5/27/71
990000580 EFLON-HOSES, SUPPORTED BY BRAIDED STAINLESS-STEEL-HOUSING, AND RUBBER-HOSES PLASITE-NO-7122H APCI-MAR-87-0
990005100 E TREATMENTS- FREE-MACHING BRASS APCI-1A6A-24 2P 2/21/72
990001510 AIN-AND-THREADED-ENDS-1RED BRASS-PIPE - APCI-DES-ENG-STD-572.1 - 5P - 5/62
990005140 S, AND SURFACE TREATMENTS- BRASS-SHEET OR PLATE ASTM-836 APCI-146A-28 2P 2/21/72
990005240 SURFACE TREATMENTS- ALPHA BRASS-TYPE TCL-100 OR DTD-5019 TUNGUM CO LTD/UK COMPOSITION- COPPER-86-PERCENT
                              APCI BRAZED ALUMINUM MEAT-EXCHANGER-CLEANING REQUIREMENTS APCI-QUAL-CONT-LAYOUT-119F
990000870
990003680 TO TENTE PEGRAMATAN. APL BRAZED CORE EXTENDED SURFACE HEAT-EXCHANGERS APL-ENGR-SPEC-E.02 9P 6/28/70
990003870 VERSON, I. APL FAILURE OF BRAZED JOINTS IN HIGH-PRESSURE GASEOUS DXYGEN-LINE AT A CYLINDER FILLING DEPOT
990002110 STANDARD FOR WELDING AND BRAZING PROCEDURES, WELDERS, BRAZERS, AND WELDING AND BRAZING OPERATORS. ASME
990005130 S, AND SURFACE TREATMENTS- BRONZE: ASTM-B61 OR B62 APC1-1A6A-27 2P 2/21/72
990003440 ILDING OFFICIALS UNIFORM BUILDING CODE VOL-1 1970
990005880 TEM-EMERGENCIES PROTECTION BUILDINGS AND ADJACENT SYSTEMS PROTECTION APCI-1VC2-1 4P: 1/10/72
990001920 REQUIREMENTS FOR CUSTOMER BULK GAS SUPPLY SYSTEM APCI-DIST-OPER-MAN-V-1-SEC-4.1.3 2P 6/71
990001930 NSPECTION REQUIREMENTS FOR BULK LIQUID CUSTOMER INSTALLATIONS APCI-DIST-OPER-MAN-V-1-SEC-4.2.3 1P 5/69
990001900 ON ASSUC INSTALLATION OF BULK DXYGEN SYSTEMS AT: CONSUMER: SITES-1965 NFPA-NO-566 10P 1965
990001910 ON ASSOC INSTALLATION OF BULK OXYGEN SYSTEMS AT CONSUMER SITES PROPOSED AMENDMENTS PART II - AMENDMENTS
990001890 YMERS, PULYSULFIDE-SEALER, BUNA-N, NEOPRENE, EPOXY-ADHESIVE, PHENULIC-MOLDED, MELAMINE-MOLDED, POLYESTER-GLASS
990003880 OSION AND FIRE OCCURRED IN BURCKHARDT CENTRIFUGAL LOX-PUMP-TYPE-GB114-NO-29224 APL-SAFETY-DEPT-REP-16 6P 2
990004210 OF THE INVESTIGATION INTO BURCKHARDT CENTRIFUGAL PUMP EXPLOSION AND TANKER FIRE AT SHEEPBRIDGE ALLOY CASTIN
990003860 ERSON,1. LANBA,J.S. APL BURCKHARDT OXYGEN COMPRESSOR FIRE AT SSPC ROGNAC PLANT 3/2/71 APL-SAFETY-BULL-1
990005950
                     DALY, J. APCI BURNING OF METALS IN OXYGEN ATMOSPHERES (80 TO 100-PERCENT) APCI-TM-186 44P
990001860
                    KEHATYES APCI BURNING OF STEEL PIPES IN: A FLOWING DXYGEN STREAM APCI-MEMO-61 04/17/61 3P PL
990001480
              BROPHY,M. APCI PIPE BURNING TESTS APCI-R+D-NOTEBOOK-111 P26-9 4P 4/17/61
990002790 APCI NEAR-MISS ACCIDENT- BURNS/HARBOK APCI-MEMO-71 02/8/71 2P
990001890 UORINATED-SILOXANE, LS-53, BUTYL-RUBBER, IRON-OXIDES; TALC, ASBESTOS, ALUMINUM-CHIPS, STEEL-WOOL, MAGNESIUM-CH
990002860
                              APCI BYRON-JACKSON OXYGEN PUMP WASHOUT PROCEDURE FOR ANALYTICAL PURPOSES APCI-POM-SE
990000730 OLYKOTE-TYPES-Z"ANDW X#15% CABOSIL-M-5 FORMICA-LAMINATE BONDED WITH A PHENOLIC RESIN, CUTTING-DILS, HEXADECAN
990001890 822, SUPERIOR-GRAPHITE-CO, CALQUARTZ-SODIUM SILICATE, 3M-DC1252-MARKEP-PUTTY, DURABLE-MANUFACTURING COMPANY-GA
990000620 AND MAPLE WOOD, ACTIVATED CARBON APCI-MAR-87-0-8821 11P :10/61
990001730 0 100F 3600-PSIG-MAX-OWG CARBON STEEL APCI-DES-ENG-STD-578.10.6 3P 6/62
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990001870 S, AND SURFACE TREATMENTS. CARBON STEEL IN OXYGEN-ATTMOSPHERES APCI-IMD-NG-LB-0043 APCI-TM-112 6P 990005000 S, AND SURFACE TREATMENTS. CARBON STEEL (OXYGEN-ATTMOSPHERES APCI-IMD-NG-LB-0043 APCI-TM-112 6P 990005000 S, AND SURFACE TREATMENTS. CARBON STEEL PIPE AND FITTINGS CLEANING ALUMINUM-PIPE FITTINGS PARTS AND FABRICA 990001850 1/2-1NCH SAFETY VALVE WITH CARBON STEEL PRING APCI-IMD-NU-10-7071 APCI-PROJECT-NU-00-5-3246-51.12.50 AP 9900051890 S, AND SURFACE TREATMENTS. CARBON STEEL—NON-GXYGEN SERVICE WITH POSSIBLE EXPOSURE TO GXYGEN APCI-IA6A-33 990001710 G 100F 140-PSIG-MAX-DWG CARBON STEEL—PIPE APCI-DES-ENG-STD-578.10.19 2P 6/62 990001720 U 100F 150-PSIG-MAX-DWG CARBON STEEL-PIPE APCI-DES-ENG-STD-578.10.5 4P 1/64 990001720 U 100F 2000-PSIG-MAX-DWG CARBON STEEL-PIPE APCI-DES-ENG-STD-578.10.1 6P 1/64 990001720 U 100F 2000-PSIG-MAX-DWG CARBON STEEL-PIPE APCI-DES-ENG-STD-578.10.1 6P 1/64 990001680 - PLAIN-AND-THREADED-ENDS- CARBON STEEL-PIPE APCI-DES-ENG-STD-578.10.1 6P 1/64 CELLULUBE-220, CELLULUBE-150, UCON-L8283, UCON-L8550, UCON-L8300, UCON-L8170, UCON-CELLULUBE-300 CELLULUBE-220 APCI-MAR-87-0-8822 1P 7/63 CELLULUBE-300, CELLULUBE-220 APCI-MAR-87-0-8822 2P 6/63 CELLULUBE-300, DTE 103, RECENT FIRES AT DUPONT-NEW/JUHNSONVILLE-PLANT SOLNUS-500, T CELLULUBE-300, DTE-103, CELLULUBE-200 RECENT FIRES AT DUPONT-NEW/JUHNSONVILLE-PLANT CELLULAR GLASS SECTION FOR PIPELINES APL-ENGR-SPEC-N.OS 5P 10/1/70 CELLULUBE-150, UCON-LB283, UCON-LB550, UCON-LB300, UCON-LB170, UCON-HB170, UCON-LB170, UCON-LB170, UCON-HB170, UCON-HB170, UCON-LB170, UCON-LB170, UCON-LB170, UCON-HB170, UCON-HB170, UCON-LB170, UCON-LB170, UCON-HB170, UCON-HB170, UCON-LB170, UCON-LB170, UCON-LB170, UCON-HB170, UCON-LB170, UCON-LB170, UCON-LB170, UCON-HB170, UCON-LB170, UCON-LB170, UCON-LB170, UCON-LB170, UCON-LB170, UCON-LB170, UCON-HB170, UCON-LB170, UCON-LB1 6/6 APL-ENGR-STD-LS.30/2 3P 1/12/7 FLORIDA 5/11-12/71 CONTROLS CHECK-LIST- AIR-SEPARATION PLANT-SITE APCI-SAFETY-STD-610.1.1 5P 11/28/60 CHECK-LIST-AIR-SEPARATION-PLANT UPERATION APCI-SAFETY-STD-610.1/5 17P 2/16/61 CHECK, FIRE-COMPARIBILITY, QUALITY-CONTROL-APL APCI-IB10(2)-2 2P 2/21/72 CHECK, FIRE-COMPATIBILITY, QUALITY-CONTROL-APCI APCI-IB10(2)-1 3P 9/9/71 APL-SAFETY-DEPT-REP-36 CARBON STEEL-PIPE APCI-DES-ENG-STD-578.10.3 3P 6/62 CARBON-DISULFIDE ALIQUIPPA PUMP-SUCTION-FILTER-DEFROST CYL-SEAL SEALING COMPOUND CARRINGTON 2/17/11 AS REPORTED IN SAFETY DEPT-REP-35 APL-SAFETY-DEPT-REP-36 CARRINGTON PLANT APL-SAFETY-DEPT-REP-35 7P PLUS APPENDIX I THROUGH VI 19P CARTER, AND COSMODYNE LOX-PUMP SAFETY APCI-MEMO-71 1/01/26/71 2P CAUTION- SNIFF TESTING CYLINDERS HAS ITS HAZARDS APCI-SAFETY-GRAM-NO-49 2P 3 CHECK, FIRE-COMPATIBILITY, CLEANING-PROCEDURES-APCI APCI-IBIC-01 14P 2/21/72 CHECK, FIRE-COMPATIBILITY, CLEANING-PROCEDURES-APL APCI-IBIC-02 1P 2/21/72 APCI-182-1 ZP 2/10/72 APCI-DES-ENG-STD-551.2.8.1 18P 2/3/71 ANUAL HATTINGEN PLANT 15P APPENDIX I II III A PC I - ME MO-62 CGA-PAMPHLET-341-TENTATIVE-STANDARDS 13P CENTRIFUGAL CRYGGENIC PUMPS APL-ENGR-SPEC-G.03 14P 4/1/71
CENTRIFUGAL CRYGGENIC PUMPS APL-ENGR-SPEC-G.03 14P 4/1/71
CENTRIFUGAL LOX-PUMP-TYPE-GB114-ND-29224 APL-SAFETY-DEPT-REP-16 6P 2/28
CENTRIFUGAL LOXYGEN COMPRESSORS APCI-DES-ENG-STD-551.2.8.1 18P 2/3/71
CENTRIFUGAL OXYGEN COMPRESSOR MANUAL HATTINGEN PLANT 15P APPENDIX I II
CENTRIFUGAL PUMP EXPLOSION AND TANKER FARE AT SHEEPBRIDGE ALLOY CASTINGS
CENTRIFUGAL PUMPS FOR LIQUID-DXYGEN CRYGGENICS V-10 PP241-248 8P 6/70
CGA AIK-SEPARATIUN EQUIPMENT COMMITTEL HELD AT FT/LAUDERDALE FLORIDA 5/ CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY MATERIALS AND PARTS SUITABILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY NOTCH-SENSÍTIVITY OF MATERIALS 9/2/11 APCI -ANAL-REP CARBGN-TETRACHLURIDE- CHLORDFURM APCI-PROJECT-NO-87-8-8821 APCI-162A-1 2P APCI-IA7A-04 IP 2/21/72 APCI-SAFETY-GRAM-NO-68 IP 2/21/69 CHECK, FIRE-COMPATIBILITY, CLEANING-PROCEDURES-APL APCI-CHECK, FIRE-COMPATIBILITY, QUALITY-CONTROL, FIRE HAZARDS APCI-550-SD-16A 37P 4/15/65 CGA-341 FOR COLD LIQUEFIED-GASES CGA-PAMPHLET-34) CGA-DOCKET 70-11 CGA-THIRD DRAFT 23P 3/22/72 CHARGING MANIFOLD APL-SAFETY-BULL-046 2P CELLULUBE-550 FLUDROLUBE SEARS-THREAD-CUTTING-OIL GASEGUS OXYGEN TRANSMISSION-LINES APL-1GD-ENGR-MAN-50-01 3P 5/27/71 2P 6/63 1P 7/63 CHECK. STRUCTURAL-MATERIALS-COMPATIBILITY 990005370 MPATIBILITY, COMPATIBILITY CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY APCI -MAR-87-0-8822 APCI-MAR-87-0-8822 CENTRIFUGAL COMPRESSORS CARBON-TETRACHLORIDE CARBUN-T ETRACHLORIDE CELLULUBE-220 CELLULUS E-220 CARBON-STEEL CARRINGTON TO 100F 720-PSIG-MAX-UWG AND EXPLOSION TESTING- CS2 OETHANE- TRICHLORETHYLENE-YOGENIC TANKER BY PUMP AT PAUL, APL INSULATION- PREFORMED GENERAL SPECIFICATION FOR 990003880 IRE OCCURRED IN BURCKHARDT 990000270 CHINERY- FIELD TESTING AND 990003070 ALL, W.L. APCI MINUTES UF 990001950 TANK-TRUCK SPECIFICATION AND SAFETY SATNDARDS FOR CALS, SOLVENTS, AND MISC-KER-400-11 2/11/71 AT THE UALITIES OF CELLULUBE-220, ES CELLULUBE-300, DTE-103, -OUT STUDIES CELLULUBE-300 ACCIDENT AT AN DXYGEN 990005350 MPATIBILITY, COMPATIBILITY TAR-GB.114-PUMP-NU-C.75 AT UT STUDIES, CELLULUBE-300, 990001400 IRE-RESISTANT QUALITIES OF DS- PLANT-WASH-DUT STUDIES I. PLANT WASH-DUT STUDIES, ARUS- PLANT-WASH-OUT STUDY OS- PLANT-WASH-OUT STUDIES DTE-105 TEXACU-CAPPELLA-AA **ESTIGATION INTO BURCKHARDT** GASSEN, K.F. FIRE TESTS UN 990003450 NSMISSION AND DISTRIBUTION MPATIBILITY, COMPATIBILITY 990005310 MPATIBILITY, COMPATIBILITY 9900C5320 MPATIBILITY, COMPATIBILITY 990005330 MPATIBILITY, COMPATIBILITY 990005560 MPATIBILITY, COMPATIBILITY 990005380 MPATIBILITY, COMPATIBILITY MPATIBILITY, COMPATIBILITY APCI APCI GLIVER, R. APL APL APCI APCI SCHMUYER, M. K. STOMPLER, R. D. APCI SCHMOYER . W. W. KITSON, F. K. 990003950 018600066 061000066 990003110 990004210 990003830 001100066 990004050 096100066 990003940 990005670 092000066 990005340 990004120 990001400 092000066 052000066 90000130 099000066 069700066 990005400 095000066 990000740 096600066 990003710 990004100 075000066

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990005390 MPATIBILITY, COMPATIBILITY CHECK. STRUCTURAL-MATERIALS-COMPATIBILITY FABRICATION AND WELDING APCI-182D-1 2P
990004420 LUBRICANTS- FLUORO-GLIDE, CHEMPLAST INC APCI-IAIA-14 1P 2/21/72
990004580 OUNDS- SODIUM-SILICATE AND CHINA-CLAY-PASTE APCI-IA2A-12 1P 2/21/72
990001890 BON-GREASE, HYDRAULIC-OIL, CHLORINATED-BIPHENYL-AROCLOR-1254, GRAPHITE-CHLOR-BIPHENYL, VINYL-CHLORIDE, CIS-DIC
990005270 CALS, SULVENTS, AND MISC- CHLOROFORM APCI-1474-03 1P 2/21/72
990001360 ENE- CARBON-TETRACHLORIDE- CHLORGFORM APCI-PROJECT-NO-87-8-8821 APCI-MEMO-62 01/3/62 5P
990001890 URIDE, METHYLENE-CHLORIDE, CHLOROFORM, ETHYL-CHLORIDE, DICHLOROETHANE, DICHLOROETHANE, TRICHLORGETHANE POLYMER
990001890 COTITE-CERAMIC-INSULATION, CHROMATE-DYED-GLASS CLOTH: 3M-SAFETY-WALK-TYPE-B-M-0070; WALK-SYNTHETIC-CORK: MASKI
990001890 -BIPHENYL, VINYL-CHLORIDE, CIS-DICHLOROETHYLENE, TRANS-DICHLOROETHYLENE, VINYLIDENA-CHLORIDE, TRICHLOROETHYLEN
990000250
                              APCI CIVIL-STRUCTURAL- PERSONNEL PROTECTIVE SHIELDS AND DXYGEN-SYSTEMS APCI-DES-ENG-ST
990000840 I PEQUIREMENTS FOR VENDOR CLASS-A CLEANING APCI-QUAL-CONT-LAYOUT-115F 2P 7/1/71
990003610 APL ACCEPTANCE TESTS FOR CLASS-A CLEANING APL-ENGR-SPEC-A.02 3P 5/12/69
990000800
                              APCI CLASS-A CLEANLINESS REQUIREMENTS APCI-QUAL-CONT-LAYOUT-105F 3P 7/1/71
990000850 I REQUIREMENTS FOR VENDOR CLASS-AA CLEANING APCI-QUAL-CONT-LAYOUT-116F 2P 7/1/71
990003620
           APL ACCEPTANCE TEST FOR CLASS-AA CLEANLINESS (OXYGEN-CLEAN) APL-ENGR-SPEC-A.03 4P 4/1/71
990000810
                              APCI CLASS-AA CLEANLINESS REQUIREMENTS: APCI-QUAL-CONT-LAYOUT-106F 3P 7/1/71
990000860 I REQUIREMENTS FOR VENDOR CLASS-AAA CLEANING APCI-QUAL-CONT-LAYOUT-117F 3P 7/1/71
990000820
                              APCI CLASS-AAA CLEANLINESS REQUIREMENTS APCI-QUAL-CONT-LAYOUT-107F 3P 7/1/71
990000830 I REQUIREMENTS FOR VENDOR CLASS-B CLEANING APCI-QUAL-CONT-LAYOUT-114F 2P 7/1/71
990003600
          APL ACCEPTANCE TEST FOR CLASS-B CLEANLINESS APL-ENGR-SPEC-A-01 2P 5/12/69
990000790
                              APCI CLASS-B CLEANLINESS REQUIREMENTS APCI-QUAL-CONT-LAYOUT-104F IP 7/1/71
990001980 SED GAS ASSOC EQUIPMENT CLEANED FOR OXYGEN SERVICE CGA-PAMPHLET-G-4.1 21P 3/59
990000540 MITH, H. APCI SOLVENT AND CLEANERS- DEVIATIONS CLEANING FOR DXYGEN SERVICE APCI-SAFETY-STD-629.0.10 1P 6/
990001010
                              APCI CLEANING
                                              APCI-CONSTR-SPEC-230.15 ON P8 1P 9/16/69
990000890 R.H.H. APCI STURAGE TANK CLEANING
                                              APCI-MEMO-63 01/24/63 1P
990002220 OR-CLASS-AA AND CLASS-AAA CLEANING
                                              APCI-MEMO-71 07/22/71 1P
990000830 REMENTS FOR VENDOR CLASS-B CLEANING
                                              APCI-QUAL-CONT-LAYOUT-114F 2P 7/1/71
990000840 REMENTS FOR VENDOR CLASS-A CLEANING
                                              APCI-QUAL-CONT-LAYOUT-115F 2P 7/1/71
990000860 MENTS FUR VENDOR CLASS-AAA CLEANING
                                              APCI-QUAL-CONT-LAYOUT-117F 3P 7/1/71
990000850 EMENTS FOR VENDOR CLASS-AA CLEANING
                                              APCI-QUAL-CONT-LAYOUT-116F 2P 7/1/71
990003610 CEPTANCE TESTS FOR CLASS-A CLEANING
                                              APL-ENGR-SPEC-A.02 3P 5/12/69
990003650 PING ERECTION: TESTING AND CLEANING
                                              APL-ENGR-SPEC-M.O2 9P PLUS APPENDIX I II III 4/19/71
990003970 ING ERECTION, TESTING AND CLEANING
                                              APL-ENGR-SPEC-M.02 8P APPENDIX I II III 3P 4/19/71
990001020 N STEEL PIPE AND FITTINGS, CLEANING ALUMINUM-PIPE FITTINGS PARTS AND FABRICATIONS, CLEANING STAINLESS-STEEL
990000950
                             APCI CLEANING AND INSPECTION FOR EQUIPMENT IN AIR PLANTS AND IN DXYGEN SERVICE APCI-PO
                              APCI CLEANING AND INSPECTION- MATERIALS AND OXYGEN SERVICE - APCI-SAFETY-STD-608.1 7P
990000500
990003350 GENERAL SPECIFICATION FOR CLEANING FOR OXYGEN SERVICE APCI-550-SD-27A 5P 12/10/59
990000540 T AND CLEANERS- DEVIATIONS CLEANING FOR DXYGEN SERVICE APCI-SAFETY-STD-629.0.10 1P 6/19/61
990000940
                 KITSON, F.K. APCI CLEANING FUR DXYGEN SERVICE APCI-MEMO-63 08/5/63 2P PLUS 9P ATTACHMENTS
990000960
                BASSLER, E.J. APCI CLEANING FOR OXYGEN SERVICE 17P 1/60
990000900
                 HATLEY, A.L. APCI CLEANING LOX STORAGE TANK-NO-6 SANTA/SUSANA APCI-MEMO-64 03/11/64 1P PLUS 1P A
990004010 ITY PROCEDURE FOR INTERNAL CLEANING OF ALUMINUM TANKERS AND STATIC-TANKS FOR OXYGEN SERVICE APL-QCP-Q12 R
990001020
                             APCI CLEANING OF CARBON STEEL PIPE AND FITTINGS, CLEANING ALUMINUM-PIPE FITTINGS PARTS
990004020 ITY PROCEDURE FOR INTERNAL CLEANING OF 9% NICKEL AND HI-PROOF STAINLESS STATIC-TANKS FOR OXYGEN SERVICE AP
                     PENNSALT CORP CLEANING OF LIQUIEFIED-GAS PROCESSING EQUIPMENT PENNSALT-TECHNICAL-BULLETIN 6P
990000360 NG- VALVE PROCUREMENT AND CLEANING PROCEDURE APCI-DES-ENG-STD-579.5 3P: 8/12/60
990005820 MAINTENANCE PROGRAM SAFE CLEANING PROCEDURES FOR FILTERS, TRAPS, AND INSTRUMENTS APCI-1118-1 2P 11/1/71
990000870 ED ALUMINUM HEAT-EXCHANGER CLEANING REQUIREMENTS APCI-QUAL-CONT-LAYOUT-119F 2P 7/1/71
990000780
                             APCI CLEANING REQUIREMENTS FOR BOURDON-TUBE TYPE GAUGES USED FOR OXYGEN SERVICE
990000770
                             APCI CLEANING REQUIREMENTS FOR AIR-PLANT EQUIPMENT APCI-QUAL-CONT-LAYOUT-101F 2P PLUS
990001020 S. PARTS AND FABRICATIONS, CLEANING STAINLESS-STEEL AND COPPER-PIPE FITTINGS: PARTS AND FABRICATIONS DESCRIPT
9900ClOSC L FIRE HAZARD WHEN VAPOUR CLEANING WITH TRICHLORDETHYLENE" (T.C.E.) APL-SAFETY-DEPT-INFO-SHEET-38 2P 2/10
990002850 MAHR, A.J. APCI: LIST OF CLEANING-AGENTS, ASSOCIATED EQUIPMENT AND SUPPLIES APPROVED FOR USE IN APCI MANUF
990001020 ABRICATIONS DESCRIPTION OF CLEANING-MEDIUMS, INSPECTION OF DECONTAMINATED COMPONENTS, AND PICKLING OF CARBON-
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990005310 CHECK, FIRE-COMPATIBILITY, CLEANING-PROCEDURES-APC1 APC1-IB1C-01 14P 2/21/72
990005320 CHECK, FIRE-COMPATIBILITY, CLEANING-PROCEDURES-APL APCI-IB1C-02 1P 2/21/72
990003600 CCEPTANCE TEST FOR CLASS-B CLEANLINESS APL-ENGR-SPEC-A-01 2P 5/12/69
990003620 CEPTANCE TEST FOR CLASS-AA CLEANLINESS (OXYGEN-CLEAN) APL-ENGR-SPEC-A.03 4P 4/1/71
990005450 DISPOSAL OF VENTED GASES CLEANLINESS OF DISPOSAL SYSTEM APCI-IIBI-L 2P 2/12/72
990005470 DISPOSAL OF VENTED GASES CLEANLINESS OF OXYGEN PIPING APCI-IIBI-2 1P 2/19/72
                    APCI CLASS-AA CLEANLINESS REQUIREMENTS APCI-QUAL-CONT-LAYOUT-106F 3P 7/1/71
990000810
990000790
                     APCI CLASS-B CLEANLINESS REQUIREMENTS
                                                             APC 1-QUAL-CONT-LAYOUT-104F 1P
                                                                                            7/1/71
990000800
                      APCI CLASS-A CLEANLINESS REQUIREMENTS
                                                             APCI-QUAL-CONT-LAYOUT-105F 3P
                                                                                            7/1/71
9900008ZO APCI CLASS-AAA CLEANLINESS REQUIREMENTS APCI-QUAL-CONT-LAYOUT-107F 3P 7/1/71 990002Z10 INSPECTION, REGARDING APCI CLEANLINESS REQUIREMENTS APCI-MEMO-71 07/22/71 2P
990003330 LUMINIZED HEAT PROTECTIVE CLOTHING APCI-SAFETY-STD-627.4.7 2P 5/68
990001890 NVILLE-76 GASKET MATERIAL, CLOTH-ASBESTOS, GLASS-COTTON-ALUMINIZED-MIL-C-8240, COCOTITE-CERAMIC-INSULATION, CH
9900C1890 ATION, CHROMATE-DYEO-GLASS CLOTH, 3M-SAFETY-WALK-TYPE-B-M-0070; WALK-SYNTHETIC-CORK, MASKING-TAPE, SHERLOCK-LE
990002520 FIRE INCIDENT IN AN OXYGEN CLOUD FIRE JOURNAL PP76-8 AND 81 4P 1/71
          APCI PLASITE PROTECTIVE COATING APCI-MEMO-60 06/9/60 2P
990001500
990001890 TON-ALUMINIZED-MIL-C-8240, COCOTITE-CERAMIC-INSULATION, CHROMATE-DYED-GLASS CLOTH, 3M-SAFETY-WALK-TYPE-8-M-007
                             APCI CODED VESSEL REPAIRS APCI-POM-SEC-6.09 4P 11/29/68 FOR ATTCHMTS SEE 205 206 APCI CODED VESSEL REPAIRS APCI-POM-SEC-6.09 4P 15P OF ATTCHMTS 11/29/68
990002040
990002280
          990001950
                 FOSTER, R. H. APCI COLD TEST OF 1/2-INCH SAFETY VALVE WITH CARBON STEEL SPRING APCI-IWO-NO-10-7071
990001850
                              APCI COLD-BOX LEAKS APCI-POM-SEC-1.14 5P 10/30/68
990002270
            APCI PLANT COMPONENTS- COLD-BOXES APCI-SAFETY-STD-607.1.5 7P 1/63
990000450
          PERLITE IN AIR-SEPARATION COLD-BOXES APCI-TB-39 1P 6/14/71
990000380
           INSULATION AND PAINTING- COLD-BOXES THERMAL TANKS PERLITE APCI-DES-ENG-STD-581.1 4P 5/26/61
990000390
           INSULATION AND PAINTING- COLD-BOXES, THERMAL TANKS, GLASS WOOL APCI-DES-ENG-STD-581.3 1P 10/24/60
990000410
990001800
                 APCI PIPING-SS36- COLD-BOX-SERVICE 100F AND BELOW 3600-PSIG-MAX-OWG STAINLESS STEEL-PIPE APCI-DES
                 APCI PIPING-SS12- COLD-BOX-SERVICE 100F AND BELOW 1235-PS1G-MAX-UWG STAINLESS STEEL-PIPE
990001770
                                                                                                           APCI-DES
                APCI PIPING-SS7.2- COLD-BOX-SERVICE 100F AND BELOW 720-PSIG-MAX-OWG STAINLESS STEEL-PIPE
990001810
                APCI PIPING-SS2.7- COLD-BOX-SERVICE 100F AND BELOW 275-PSIG-MAX-UWG STAINLESS STEEL-PIPE APCI-DES-
990001750
                  APCI PIPING-SS6+ COLD-BOX-SERVICE 100F AND BELOW
                                                                     615-PSIG-MAX-OWG STAINLESS STEEL-PIPE APCI-DES-
990001760
                 APCI PIPING-SS30- COLD-BOX-SERVICE 100F AND BELOW
                                                                     3000-PSIG-MAX-OWG STAINLESS STEEL-PIPE APCI-DES
990001790
                  APCI PIPING-CT2- COLD-BOX-SERVICE 100F AND BELOW
                                                                     200-PSIG-MAX-DWG COPPER-TUBE APCI-DES-ENG-STD-
990001620
                APCI PIPING-AA1.5- COLD-BOX-SERVICE 100F AND BELOW 150-PSIG-MAX-OWG ALUMINUM APCI-DES-ENG-STD-571.
990001570
                  APCI PIPING-CT4- COLD-BOX-SERVICE 100F AND BELOW 400-PSIG-MAX-OWG COPPER-TUBE APCI-DES-ENG-STD-
990001630
                  APCI PIPING-AA3- COLD-BOX-SERVICE 100F AND BELOW 300-PSIG-MAX-OWG ALUMINUM APCI-DES-ENG-STD-571.
990001580
                 APCI PIPING-AA.3- COLD-BOX-SERVICE 150F AND BELOW 30PSIG-MAX-ONG ALUMINUM APCI-DES-ENG-ST0-571.2
990001560
                 APCI PIPING-ICT4- COLD-BOX-SERVICE-PROCESS-INSTRUMENT-PIPING 100F AND BELOW 400-PSIG-MAX-ONG COPPER
990001640
                 APCI PIPING-IAA9- COLD-BOX-SERVICE-PROCESS-INSTRUMENT-PIPING 100F AND BELOW 900-PSIG-MAX-OWG ALUMIN
990001600
                APCI PIPING-1CT23- COLD-BOX-SERVICE-PROCESS-INSTRUMENT-PIPING 100F AND BELOW 2300-PSIG-MAX-OWG COPPE
990001670
                 APCI PIPING-ICT9- COLD-BOX-SERVICE-PROCESS-INSTRUMENT-PIPING 100F AND BELOW 900-PSIG-MAX-OWG COPPER
990001650
                 APCI PIPING-IAA4- COLD-BOX-SERVICE-PROCESS-INSTRUMENT-PIPING 100F AND BELOW 400-PSIG-MAX-OWG ALUMIN
990001590
                APC1 PIPING-ICT10- COLD-BOX-SERVICE-PROCESS-INSTRUMENT-PIPING 100F AND BELOW -1000-PSIG-MAX-OWG COPP
990001660
           INSULATION AND PAINTING- COLD-INSULATION AND MINERAL FIBER GRANULATED APCI-DES-ENG-STD-581.2 2P 6/26/69
990000400
                   BALL, W. L. APCI COMBUSTIBLE CONTAMINANT CONTENT IN GRAPHITE IMPREGNATED ASBESTOS-PACKING TEFLON CO
990001440
990001420 KET MATERIALS WITH DXYGEN COMBUSTION IN DXYGEN AND SOXHLET ETHER-EXTRACTION GARLOCK-900, KM-226, KM-246 AP
990001410 RATH MATERIAL WITH DXYGEN COMBUSTION IN DXYGEN AND SUXHLET ETHER-EXTRACTION MELRATH GARLOCK-900 APCI-ANAL-R
            EROPHY.M. APCI DXYGEN COMPATABILITY TESTS- MOLYLUBE-KOTE-AR AND MOLYLUBE-N APCI-R+D-NOTEBOOK-130 P16-
990001200
990001220 CI PERMATEX SEALANT-1516- COMPATABILITY TESTS WITH HIGH-PRESSURE OXYGEN APCI-R+D-NOTEBOOK-111 P152 1P 1/
9900G1370 APCI HIGH-PRESSURE DXYGEN COMPATABILITY TESTS WITH SILICONE-RUBBER GASKET COMPOUND RTV-60-NP-134372-M235 A
990001420 R. APCI GASKET MATERIALS COMPATBILITY OF GASKET MATERIALS WITH OXYGEN COMBUSTION IN OXYGEN AND SOXHLET ET
990005350 I MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPARIBILITY, QUALITY-CONTROL-APL APCI-IBID(2)-2 2P
990005330 I MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, QUALITY-CONTROL, FIRE HAZARDS APCI-1810
9900C5340 I MATERIAL-COMPATIBILITY, COMPATIBILITY CHECK, FIRE-COMPATIBILITY, QUALITY-CONTROL-APCI APCI-181D(2)-1 3P
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COMPATIBILITY OF MATERIALS WITH LIQUID CNYGEN MASA-TMX-935 72P 8/64
COMPATIBILITY OF MATERIALS WITH LIQUID CNYGEN MTP-P+VE-M-63-14 94P 12/4/63
COMPATIBILITY OF MATERIALS WITH LIQUID CNYGEN IV NASA-TMX-53773 50P 8/23/63
COMPATIBILITY OF MATERIALS WITH LIQUID CNYGEN III NASA-TMX-53733 54P 11/3/66
COMPATIBILITY OF MATERIALS WITH LIQUID CNYGEN MASA-TMS-53052 34P 5/26/64
COMPATIBILITY OF MATERIALS WITH LIQUID CNYGEN METHYL-CHLORIDE, METHYLENE-CHLORIDE,
COMPATIBILITY OF MATERIALS WITH LIQUID CNYGEN METHYL-CHLORIDE, METHYLENE-CHLORIDE,
COMPATIBILITY OF MELRATH MATERIAL WITH CNYGEN COMBUSTION IN CNYGEN AND SCALANT, ANDE
COMPATIBILITY TESTS ON MOLY-LOBE-NO-99 APCI-MEMO-63 06/11/63 1P
COMPATIBILITY TESTS WITH HIGH-PRESSURE CNYGEN APCI-R+D-NOTEBOOK-130 P3 1P 6/63
COMPATIBILITY TESTS WITH HIGH-PRESSURE CONYGEN APCI-R+D-NOTEBOOK-130 P3 1P 6/63
COMPATIBILITY TESTS WATCH-MEMO-63 05/17/63 1P
                                                           CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY MATERIALS AND PARTS SUITABI CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY NOTCH-SENSITIVITY OF MATERI
                                                                                                                                                                                              FOR GASEOUS OXYGEN SYSTEMS MAB-3268-69 9P 11/5/69
OF CROSSLITE FLUORGCARBON TAPE THREE-M-FLUOROCARBON-TAPE, PERMACEL-TA
                                                                                                                                                                                                                                                                OF MATERIAL WITH DXYGEN JOHNS-MANVILLE ASBESTOS SHEET PACKING STY
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       CGA-PAMPHLET-V-1 57P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           PRODUCTS INC, ALUMINUM-GXIDE, SEAM COMPOUN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        ASA-857.1 57P 1965
     APCI-181C-01
                                                                                                                             CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY APCI-182-1 2P 2/10/7 CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY FABRICATION AND WELDING
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              3ALL, W.L. APCI UXYGEN COMPRESSOR FIRE APCI-SAFETY-GRAM-NU-03 2P 7/7/61
APL BURCKHARDI UXYGEN COMPRESSOR FIRE AT SSPC RUGNAC PLANT 3/2/71 APL-SAFETY-BULL-107 3P 4/14/71
APL CENTRIFUGAL OXYGEN COMPRESSOR MANUAL HATTINGEN PLANT 15P APPENDIX I II III 8P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               COMPRESSED-AIR AND OXYGEN RICH ENVIRONMENTS APL-SAFETY-DEPT-INFO-SHEFT-33
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                COMPRESSION SYSTEM EL/SEGUNDO/CALIF APCI-CONSTR-SPEC-200.0 TO 200.20 20P COMPRESSIVE-LOADS AT AMBIENT AND LIQUID-NITROGEN TEMPERATURES APCI-TR-53
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               APCI 1P
                                     APCI-IB2A-1 2P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    APCI OPERATIONAL-HAZARDS- CONTAMINANTS ACUUMULATION APCI-TIE-I 1P 7/21/71
PERCENT ETHER EXTRACTABLE CONTAMINANTS AND FLUGRESCENCE DAMCO-TEFLUN TAPE, SANDEM-INDUSTRIAL, CRANE
CI NOTES ON LIQUID OXYGEN CONTAMINANTS MISSILE-PROGRAM 10P 1/6/58
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    1/161/1
                                                                                                                                                                                                                                                                                            GF MATERIALS WITH 7500-PSI DXYGEN AD608260 71P 10/64
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           CSA-896
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 COMPRESSED-GAS STORAGE-CONTAINERS CGA-PAMPHLET-S-1.3 11P 1966 COMPRESSED-GASES APCI-SAFETY-STD-607.2.2.5 PI-4 3/65 P5-6 1/64
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           CONSHOHOCKEN APCI-MEND-68 05/23/68 2P
CONTAMINANT CONTENT IN GRAPHITE IMPREGNATED ASSESTOS-PACKING TEFLON
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DEMAG-LETTER TO
  FIRE-COMPATIBILITY, CLEANING-PROCEDURES-APCI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 APCI-DES-ENG-STD-570.7 32P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      MATERIALS APCI-SAFETY-STD-609.1 8P 6/65
GAS CYLINDER VALVE OUTLET AND INLET CONNECTIONS
GAS CYLINDER VALVE OUTLET AND INLET CONNECTIONS
GAS CYLINDER VALVE OUTLET AND INLET CONNECTIONS
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                               CHECK, STRUCTURAL-MATERIALS-COMPATIBILITY
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APCI-DES-ENG-STD-551.2.8.1 18P 2/3/71
ND PUMPS APCI-IIF3-4 15P 1/23/72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      CGA-PAMPHLET-P-1 10P 1965
CGA-PAMPHLET-S-1.1 20P 1969
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              APCI-SAFETY-STD-607.1.2.3 6P 12/62
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            COMPRESSUR SUCTION APCI-MEMO-71 07/26/71 2P
COMPRESSUR SYSTEM APCI UPERATED APCI-DES-ENC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               990003050 G KA-27-IV/KA-4-IV GXYGEN COMPRESSOR VITON-A (BLACK) VITON-E60 (GREEN)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         APCI-550-SD-01A 37P 3/9/64
APCI-550-SD-16A 37P 4/15/65
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  CHECK,
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                                  MATERIAL-COMPATIBILITY,
  MATERIAL-COMPATIBILITY,
                                                                                                                                                                                                                              GASEGUS UXYGEN
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990001320 KEL-F HIGH-PRESSURE OXYGEN
990000510 ILITY OF MATERIALS- OXYGEN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    990002350 COMPRESSED GAS ASSOC
990002880 RUCTION FOR REGULATORS AND
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  990004230 I. APL FIRE HAZARDS IN 990003150 EF DEVICE STANDARDS PT-3
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 990000440 S- AIR-SEPARATION, OXYGEN, 990002600 BALL, APCI OXYGEN
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ASS 0C
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T.AL UNION CARBIDE CORP
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990002360 MERICAN STANDARDS
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CONTRULLED KINCILLS LAILED STORMS CONTRULLED KINCILLS LAILED KINCILLS COPPER APCI-1464-25 2P 2/21/72 COPPER APCI-1464-35 2P 2/21/72 COPPER-PIPE ASIM-842 APCI-1464-04 IP -2/21/72 COPPER-PIPE FITTINGS PARTS AND FABRICATIONS DESCRIPTION OF CLEANING-MEDIUMS, INSP COPPER-PIPE FITTINGS PARTS AND FABRICATIONS OF 2/21/72 LIQUID CONTAINER APL-IGD-ENGR-MAN-52-02 7P 6/3/71
LIQUID CONTAINER APL-IGD-ENGR-MAN-52-02 7P 6/3/71
LIQUID HOSE-COUPLINGS FOR USE IN THE U.R APL-ENGR-STD-LS.08 6P 10/2
LIQUID STÜRAGE TANKS APCI-IFFI-3 TP 2/3/72 ASME WINTER ANNUAL INTERNATIONAL CONFERE APCI-MEMII-63 APLI PLANT MANAGERS SAFETY MEE SUPPOSTED BY BPAIDED STAINLESS-STEE SYSTEMS MILEDAM URETHANE, INSULATION NATIONAL-GYPSUM-BLUE LOX-SYSTEMS FOA #PL-1GD-ENGR-MAN-50-01 3P 5/27/71 CORE EXTENDED SURFACE HEAT-EXCHANGERS APL-ENGR-SPEC-E.02 9P 6/28/70 CORRUSION CONTROL FEDERAL REGISTER VOL-36 NO-126 6/30/71 CORRUSION-PITTING- NOTICE OF PUBLIC HEARING FEDERAL REGISTER VOL-36 NO-126 LOSMODYNE LOX-PUMP SAFETY APCI-MEMO-71 1/01/26/71 2P APCI-PUM-SEC-6.09-ATTCHMT-1 2P 8/27/69 COST-PROCEDURES DIST-OPER-MAW-VOL-4-SECT-6.3 APCI-MEMO-66 IG/17/66 2P PLUS COUPLING TO OTHER SYSTEMS APCI-IIC1-1 APCI-IIC2-1 IP 12/22/71 CRACK GROWTH-RATES AND FRACTURE TOUGHNESS STUDY OF WELDED ALUMINUM ALLUY-5083 CRACK-PROPAGARION IN PLATES UNDER EXTENSION AND GENDING ASME WINTER ANNUX GRACK-PROPAGARION IN PLATES UNDER EXTENSION AND BENDING INTERNATIONAL CONFIDENCE. APCI-MAR-87-0-8820 1P 5/60 APCI-ANAL-REP-71-446 1P 10/25/71 SAFETY CONFERENCE ALLENTOWN 145P 7/59 APC1-PUM-SEC-1.17 8P 4/23/69 ((FLAT-BCTTOM) APCI-99420A 18P 9/15/71 ESSO-REPORT-NO-EE,26ER,70 17P 8/24/70 JANTELLICE DESIGN IN CRIDGE CONTROLL CONTROLL CONTRIBUTED CONTRIBU CROSSLITE FLUOROCAKBON TAPE THREE-M-FLUOROCARBON-TAPE, PERMACEL-TAPE 4/62 IBLIGGRAPHY APCI-REPURT P36 2/28/64 APCI-0ES-ENG-ST0-514.6.2 4P 5/26/61 CRYOGENIC CONTAINERS (250-GALLON CAPACITY OR LARGER) GENERAL CRYOGENIC CUNTAINERS (250-GALLON CAPACITY OR LARGER) APCI-C APC1-54FETY-510-607.1.20 3P APCI-ANAL-REP-70-368,70-369 1P 16/7/70 APCI-DES-ENG-ST0-534.1 (TO BE PUBLISHED) APCI-1A2A-06 2P 2/21/72 ING CO-TAPE APCI-1A2A-09 2P 2/21/72 APCI-MEMO-68 06/4/68 2P 11/1/68 11/1/68 CONTROLLED KINETICS EXPERIMENTATION- TEFLON-HOSE CONTROLLED KINETICS EXPERIMENTS- TEFLON-HOSES, SU 2/21/72 CONTAMINATION-CONTROL APCI-IIF26-1 IP 9/3/71 CONTRACT HITH MARYLAND CASUALTY CO APCI-POM-ASIM-875 APCI-IA64-05 1P 2/21/72 ASIM-888 APCI-IA64-05 ... CONTAMINATION- HISTORY, SAMPLING, AND ANALYSIS 19/4 LIQUIDS AND ASSOCIATED EQUIPMENT CRYCGENIC LIQUID STURAGE-TANK (FLAT-BETTOM) Т. 22 25 28 APC I - I WD - NO - XD - 01 34 50 CRYDGENIC TRANSFER-LINES BISLISCRAPHY CRYOGENIC LIQUID DISPOSAL APC1-DES-EN APCI-DES-ENG-STD-574.52 APC1-0ES-ENG-STD-574.50 APCI-UES-ENG-ST0-574.54 APC1-UES-ENG-STU-574.51 APCI-DES-ENG-STD-574.1 APCI-MEMO-59 01/28/59 2P AIR-SEPARATION PLANT, CHYGGENIC-LIQUID, AND DISPUSAL CROSSL IT E-FLUOROCARBUN-TAPE CRYGGENIC PRESSURE-VESSELS PACKING CO APC COPPER-TUBE ASTM-875 CREST PRUDUCTS CO AGE, CONVERTER-SYSTEM, AND CRYDGENIC-LIQUIDS CONTROL-PANEL COPPER-TUBE COPPER-TUBE COPPER-TUBE COPPER-TUBE COPPER-TUBE COPPER-TUBE CREIGHT ON CRYOGENIC 990003780 PEGRAM, J. W. APL CRYCGENIC 990005580 SYSTEMS- FIELD FABRICATED GRYCGENIC CRYCGENIC CRYOGENIC CRYUGENIC CR ANE CRANE CRANE CXYGEN 990004900 S, AND SURFACE TREATMENTS-990001020 LANING STAINLESS-STEEL AND 990001650 ND BELDN 900-PSIG-MAX-DWG 990001640 ND BELDN 400-PSIG-MAX-DWG 990001670 D SELOW 2300-PSIG-MAX-DWG 990004910 S, AND SURFACE IREAIMENTS-990005180 S, AND SURGACE IREAIMENTS-990005490 APCI OPERATIONAL-HAZARDS-990002160 R. LEHIGH UNIV FATIGUE 990002140 F MEAN STRESS ON FATIGUE 990002810 APCI NEAR-MISS ACCIDENT-990003120 ESIN- 7139-CATALYST) FROM 990002380 OCEDURE FOR TRANSPORTABLE 990002390 OCEDURE FOR TRANSPORTABLE APPROVED ALLOY STEELS IN 990000970 APCI AIR-SEPARATION-PLANT 990005630 D PIPELINE-TRANSPORTATION APCI FIELD INSPECTION 990005110 FACE TREATMENTS- BERYLLIUM 990005090 S. AND SURFACE TREATMENTS-990001610 RATING TABLES- PLAIN-ENDS 990001600 BELON -1000-PSIG-MAX-GWG BRAZED 990003560 STANDARDS REQUIREMENTS FUR 990003550 TANDARDS FUF GAS PIPELINES 990002670 APCI PAUL, CARTER, AND 990002250 UALITY ASSURANCE, PRUGRAM 990001110 LASTIC LEAD SEAL-NO-Z-JOHN 990001150 N TAPE, SANGEM-INDUSTRIAL, 990004530 S AND THREADING COMPOUNDS-990004520 S AND THREADING COMPOUNDS-APL PURGE PROCEDURE FUR APL TRANSFER HOSE FOR INSULATION MATERIALS FOR 990003580 NALYSIS OF WATER-HAMMER IN URE-VESSELS- VAPORIZER AND ION FUR A FIELD-FABRICATED 990002150 US 10 SAFE-LIFE DESIGN IN FUR THE INSTALLATION OF A 990001130 US GXYGEN COMPATIBILITY OF 990002130 UNIV COMPARATIVE STUDY OF APC I SAFE HANDLING OF APLI GEIST, J. M. APUL GEIST, J.M. APC L PEGRAM, J. M. APL 990003710 LIVER,K. ್ರ 990002050 990004150 990003750 990002830 990002920 990000150 0+0000066 990004170 990004140 990000480 990000470 02<0000055 990000880 990003410 010900066 990004120 990002430

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CRYOSTAR-GB114 LOX-PUMP ON AN SSPC. LUX-TANKER APL-SAFETY-DEPT-REP-32 9P 7/10/7 CRYOSTAR-GB114 LOX-PUMP ON TANKER-400-11 2/17/71 AT THE CARRINGTON PLANT A CRYOSTAR-GB-114-PUMP-NO-C.75 ON TANKER-400-11 2/17/71 AS REPORTED IN SAFETY DEPT-RE CSZ CAKBUN-DISULFIDE ALIQUIPPA PUMP-SUCTION-FILTER-DEFROST CYL-SEAL SFALING COMPOUN CS-51-ASBESTUS AND CEMENT BUARDS. NATURAL-UNTREATED-FINISH TURNERS ASSESTOS CEM
                                                                                                                                                                                                                                                                                                                                                                            CUTTING OUTFITS APCI-BROCHURE 11P 9/25/69
CUTTING OILS TO THEIR OXYGEN-COMPATIBILITY AICHE-CEP-TECH-MANUAL SAFETY IN AIR
CUTTING-OILS APCI-MAR-87-0-8822 1P 5/63
CUTTING-OILS, HEXADECANE, HYDRUCARBON TYPE CUTTING-UILS, KNOWN AS TYPE-GROUP-II, PL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           DAMCG TAFE APCI-IA2A-07 2P 2/21/72
DAMCG-TEFLON TAPE, SANDEM-INDUSTRIAL, CRANE PACKING CO APCI-ANAL-REP-70-368,70-
DARKNESS APCI-SAFETY-GRAM-NO-58 IP 3/15/67
DAIA- ACCIDENT/INCIDENT INVESTIGATION AND REPORT-APCI OCCUMENTS LIST COVERING SA
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OEVCON-F, FOAM-TYPE INSULATIONS STYROFOAM AND POLYURETHANE-FOAM-INSULATION, RAYBEST
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              DICHLORGETHANE- TRICHLORGETHANE- TRICHLORETHYLENE- CAPBON-TETRACHLOPIDE- CHLORUFOPM
DICHLORGETHANE, DICHLORGETHANE, TRICHLORDETHANE POLYMERS, PCLYSULFIDE-SEALER, BUNA-
DICHLORGETHANE, TRICHLORGETHANE POLYMERS, PCLYSULFIDE-SEALER, BUNA-N, NEOPRENE, EPO
DICHLOROTHANE APCI-1874-01 IP 2/21/72
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        4-PERCEN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                CUTTING-DILS, KNOWN AS TYPE-GROUP-II, PLANT WASH-GUT STUDIES, CELLULUBE-300, CELLUL CYLINDER APCI-CES-ENG-SID-515.1.3 3P 10/17/60
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DEPOT APL-SAFETY-BULL-114 3P 7/13/71
DESIGN AND CONSTRUCTION OF LARGE, WELDED, LOW-PRESSURE STORAGE TANKS API STAND
DESIGN AND SAFETY SATNDARDS FOR CARBON-STEEL GASEGUS OXYGEN TRANSMISSION-LINES
DESIGN GUIDELINES AND TEST DATA-HANDBOOK MSC-02681 380P 5/29/70
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DECONTAMINATION UF STATIC-TANK AND ROAD-VEHICLE-ASSEMBLIES FCR OXYGEN SERVICE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            DEFECTS AND FAILURES IN PRESSURE-VESSELS AND PIPING REINHULD PUBLISHING CORP
DEFROST AND OF METHYLENE-CHLORIDE APCI-MEMO-61 12/11/61 2P
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DECONTAMINATED COMPONENTS, AND PICKLING OF CARBON-STEEL PIPE AND FITTINGS
DECONTAMINATION AND TEST REQUIREMENTS APL-ENGR-SPEC-L, 06 4P 7/7/69
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                                                                                                                                                                                                                                        CUSTOMER BULK GAS SUPPLY SYSTEM APCI-DISI-UPER-MAN-V-1-SEC-4.1.3 CUSTOMER INSTALLATIONS APCI-DISI-UPER-MAN-V-1-SEC-4.2.3 IP 5/69 CUTTING NFPA-NO-51 8P 1969 AND CUTTING AND WELDING PRUCESSES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            CYLINDER FILLING AND QUALITY CONTROL (STANDARD PURITY GASES) A CYLINDER FILLING AND QUALITY CONTROL (STANDARD PURITY GASES) A CYLINDER FILLING DEPOT APL-SAFETY-BULL-114 3P 7/13/71 CYLINDER INTO A ROCKET APCI-SAFETY-BULL-114 3P 7/13/71 CYLINDER VALVE OUTLET AND INLET CONNECTIONS CSA-B96 57P 1965 CYLINDER VALVE OUTLET AND INLET CONNECTIONS GGA-PAMPHLET-V-1 57P CYLINDER SEFORE REFILLING APCI-SAFETY-GRAM-NO-31 2P 8/21/63 CYLINDERS FOR COMPRESSED GASES CGA-PAMPHLET-S-1:1 20P 1969 CYLINDERS HAS ITS HAZARDS APCI-SAFETY-GRAM-NO-49 2P 3/26/65
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                                     PLANT 8/7/70
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   1970
                               CRYUSTAR LOX-PUMP EXPLOSION AT STOKE
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   MANUAL
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CRYGGENICS SAFETY
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                                                                                                                                                                                                                                                                                                                                                   CUTT ING
                                                                                                                                                                                                                                                                                                          990002420 ST SYSTEMS FUR WELDING AND 990002720 ETY SAFETY IN WELDING AND
                                                                                                                                                                                                                                                                                                                                                                                                                     990002010 THE CHEMICAL STRUCTURE OF 990000720 RDS- KEL-F-POLYMER, NYLON,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   990000160 LS- GASEOUS OXYGEN STORAGE 990000050 CHMOYER, W.W. APCI OXYGEN 990004160 ERS, J. APL PROCEDURE FOR
                                                                                                                                                                      990006640 DS, AND EXPLOSION TESTING-
990004840 ETS AND PACKINGS- SINDANYU
                                                                                                                                                                                                                                                                              QUIREMENTS FOR BULK LIQUID
                                                                                                                                                                                                                                                                                                                                                                                      990002890 DUCTS REDI-SET WELDING AND
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       DED WITH A PHENGLIC RESIN,
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                               990003930 1. APL INVESTIGATION OF
990003920 LOSION AND FIRE DUE TO THE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                990000730 XADECANE, HYDROCARBON TYPE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               990000640 UMP-SUCTION-FILTER-DEFRUST
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  QUIPPA PUMP-SUCTION FILTER
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                                                                                                 PL REPORT ON EXPLOSION OF ARISING FROM EXPLOSION OF
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990002350 AS ASSUC COMPRESSED
990002360 DS ASSUC COMPRESSED
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DRY DXYGEN SERVICE -20F TO 100F 720-PSIG-MAX CARBUN-STEEL APCI-DES-ENG-STD-5 ORY UXYGEN SERVICE -20F TO 100F 275-PSIG-MAX CARBUN-STEEL APCI-DES-ENG-STD-5 DRY DXYGEN SERVICE -20F TO 100F 500-PSIG-MAX-OWG CARBUN-STEEL APCI-DES-ENG-S DKY OXYGEN SERVICE -20F TO 100F 150-PSIG-MAX-CARBUN-STEEL APCI-DES-ENG-S DKY OXYGEN SERVICE -20F TO 100F 150-PSIG-MAX CARBUN-STEEL APCI-DES-ENG-STD-5 OTD-50.9 TUNGUM CO LTD/UK COMPOSITION COPPERCENT ALUM-1.20-PERCENT NIC 5TE 103, RECENT FIRES AT DUPONT-NEW/JOHNSONVILLE-PLANT SGLNUS-503, TITANIUM-TETRACH OTE-103, CELLULUBE-200 RECENT FIRES AT DUPONT-NEW/JOHNSONVILLE-PLANT TITANIUM, TITA TEEL-CORP ECURSE-MICHIGAN 2P 6/21/61
PLASTICS, ELASTOMERS, AND ADHESIVES- NEGRACHE ARCI-144A-05 IP 2/21/72
PLASTICS, ELASTOMERS, AND ADHESIVES- REENC-PINDER ARCI-144A-02 IF 2/21/72
PLASTICS, ELASTOMERS, AND ADHESIVES- RICHORD RITH SS-4004-SILICONE-PPLASTICS, ELASTOMERS, AND ADHESIVES- RICHORD APLILAGA 24 IF 2/21/72
PLASTICS, ELASTOMERS, AND ADHESIVES- NYLON A PCI-144A-04 IF 2/21/72
PLASTICS, ELASTOMERS, AND ADHESIVES- NYLON ARCI-144A-05 IP 2/21/72
PLASTICS, ELASTOMERS, AND ADHESIVES- NYLON ARCI-144A-05 IP 2/21/72 DON-T TUKN A CYLINDER INTO A RUCKET APCI-SAFETY-GRAM-NO-04C IP 8/7/61
DOW-CGRNING FLUDRINATED SILICON-UILS, SHELL POLYURETHANE FGAM (EPON-FOAM-H-60) AP
DOW-CGRNING-4 COMPOUND SILICONE, DOW-CORNING-4X COMPOUND-SILICONE, FAIRBANKS-SILICO
DOW-CGRNING-4X CUMPOUND-SILICONE, FAIRBANKS-SILICONE-DC-44, MORSE GREASE, ALPHA-CGR OUF ABLE-MANUFACTURING COMPANY-GASKET MATERIAL, JOHNS-MANVILLE-76 GASKET MATERIAL, C OYE-PENETRANTS, MAGNGGLO-PASTEID IN KEFOSENE, TURCU-DYE-CHECK-STEP-2-LIQUID, TURCO DYE-PROCESS-SGLUTIONS, TURCU-DYE-CHECK PROCESS, ZYGLO-ZE-Z-EMULSIFIER, ZYGLO-ZP-5-D DOW-CORNING-RF-1-0005, INDOPOL-POLYBUTENE-OIL AMGCG-L-ID, INDOPOL-POLYBUTENE-OIL AM DOW-CORNING-RF-1-0065, SILICON-OILS DOW-CORNING-RF-1-0065, INDOPOL-POLYBUTENE-OIL A COM-CORNING-SILICONE-PAINT-XP-7-1003, GRIP-CLAD-PRIMER, SHERWIN-WILLIAMS-E41A4, SUP DOW-CORNING-SILICONE, PAINT-ON-GALBESTGS, DOW-CORNING-SILICONE-PAINT-XP-7-1003, GRI ORAINAGE AND ULTIMATE DISPOSAL ARRANGEMENTS APCI-1101-1 2P 8/22/71 DRAIN-LINE EXPLOSION APCI-SAFETY-GRAM-NO-24 2P 1/17/63 DRAWING 1200-SERIES REGULATIONS APCI-DRAWING-000-0-407004E 1P 3/4/68
DRI-LUBE APCI-MAR-87-0-8821 1P 4/62
DRILUBE-1, TEFLUN DISPERSION-T-FILM, HYDROCARBON-GREASE, HYDRAULIC-DIL, CHLORINATED DUPONT-NEW/JOHNSONVILLE-PLANT TITANIUM, TITANIUM-DIOXIDE, SOLNUS-500, HYDROCARBON-O APC I-MAK-87-0-88 APCI-IIBI-1 2P 2/12/7 HYDRAULIC-OIL, CHLORINATED-BIPHENYL-AROCLUR 2/16/12 APC 1-MEMU-71 06/2/71 DIST-OPER-MAN-VOL-4-SECT-6.3 APCI-MEMD-66 10/17/66 2P PLUS SCHEDULE FOR APCI-II84-1 1P 2/19/72 DISPUSAL SYSTEM APCI-II61-1 2P 2/12/72
DISPUSAL SYSTEMS APCI-II02-1 1P 8/22/71
DISPUSAL SYSTEMS APCI-II02-1 1P 8/22/71
DISPUSAL OF VENTED GASES PROCEDURAL ARRANGEMENTS APCI-II84-1 1P 2/19/
DISPOSAL OF VENTED GASES COMPANY PRACTICES APCI-II8-1 5P 11/1/71
DISPUSAL OF VENTED GASES CLEANLINESS OF OXYGEN PIPING APCI-II61-2 1P
DISPUSAL OF VENTED GASES CLEANLINESS OF DISPOSAL SYSTEM APCI-II81-1 2 OUPCNT-WEK/JOHNSONVILLE-PLANT SOLNUS-500, TIITANIUM-TETRACHLORIDE ES CLEANLINESS OF DISPOSAL SYSTEM APCI-DRAWING-92483D REV-8 9/30/68 DURABLA JUHNS-MANVILLE ASBESTUS SHEET PACKING STYLE-61 4P 5/26/61 3P 4/62 2P 8/22/71 APCI-1A2A-03 1P 2/21/72 LISPERSION-T-FILM, HYDROCARBON-GREASE, AGE DRAINAGE AND ULTIMATE DISPOSAL ARRANGEMENTS APCI-IIDI-I APCI-SAFETY-STD-607.1.20 2/21/72 2/21/72 2/21/72 2/21/72 2/21/72 2/21/72 2/12/12 2/21/12 APC1-1181-1 DISPUSAL-TANK-500-GAL APC 1-145A-10 APCI-IA1A-08 APC I-1A1A-10 APC 1-144A-06 A PC I - I A 5 A - 1 1 APC 1-1A1A-09 APC 1-1A1A-15 APCI-IAIA-0 990005450 NTED GASES CLEANLINESS OF DISPUSAL 990005520 LS AND IGNITION SUURCES IN DISPOSAL YABLE-A, DRILUBE-1, TEFLCN DISPERSI RIZER AND CRYDGENIC LIQUID DISPOSAL ANT, CRYOGENIC-LIQUID, AND DISPOSAL DUPONT DUPONT DUPCNI DUPONT DUPONT DUPONT DUPCNT DUPCNI 990005510 AZARĎS- SPILLS AND LEAKĀGĒ 990000040 SCHMUVER,w.w. APCI 990003080 SCHNVDER,R. APCI MASTER APCI OPERATIONAL-HAZARDS, APCI OPERATIONAL-HAZARDS-990002250 E PRUGRAM COST-PRUCEDURES 990004+90 HREADING COMPOUNDS- T-FILM AT GREAT-LAKES-STEEL-CORP 9900C5480 APCI OPERATIONAL-HAZAROS-APCI OPERATIONAL-HAZARUS-990001890 ICONE, PAINT-ON-GALBESTOS, 990001890 OPER, PROTECTIVE-COATINGS, SCHNYDER, R. APCI MASTER ANTS, MOLY-SPRAY-KUTE, AND PIPING-PIPING-APCI LOX AND LIN VAPOR BOMBS AND SPARK-IGNITION, 990001400 RNING-4 COMPOUND SILICONE, 990000650 NG-RF-I-0065, SILICON-DILS 990000650 SION TESTING- SILICON-DILS ELECTROFILM-SPRAYABLE-A, PIPING-PIPING-990005240 LPHA BRASS-TYPE TCL-100 OK 990000750 H-JUT STUDY CELLULUBE-300, 990004380 RICANTS- KRYTUX-143-AZ-OIL 990004430 RICANTS- KRYTUX-143-AD-UIL 990004820 KETS AND PACKINGS- TEFLON, SKET MATERIALS GARLOCK-900 401-SILICONE, PYDRAUL-F-9, OUT STUDIES CELLULUBE-300, 990004250 RICANIS- KEYTOX-143-AA-01L 990004360 RICANTS- KRYTOX-143-A8-GIL 990004370 RICANTS- KRYTUX-143-AC-GIL 990004710 RS, AND ADHESIVES- VITON-A 990004830 KETS AND PACKINGS- VITUN-A 990000740 LULUBE-200 RECENT FIRES AT 990000750 DTE 103, RECENT FIRES AT E. SM-DC1252-MARKER-PUTIY. UM-CHIPS, MAGNESIUM-SHEET, 390001890 YGLU-ZL-ZZ, ZYGLO-ZLX-390, KITSON, F.K. APCI APCI APCI APCI APCI 05500066 990008470 990005450 009000066 042000066 069100066 069100066 990002590 990000470 996005510 990002470 010000066 000100066 089000066 068100066 990000330 016000066 990004700 9900C46 70 990000320 00000066

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ENGINEERING V-13 P555-565 11P 1968
ENVIRONMENTAL WARNINGS AND ESCAPE SYSTEMS APCI-11D3-1 1P 8/22/71
ENVIRONMENTAL WARNINGS AND ESCAPE SYSTEMS APCI-11D3-1 1P 8/22/71
EPGN-H-60, POLYCEL-440R, AND STYRGFUAM, LUBRICANTS, MCLY-SPRAY-KÖTE, AND DRI-LUBE
EPGXY CUMPOUNDS DEVCON-2-TON AND DEVCON-F, FOAM-TYPE INSULATIONS STYRGFOAM AND POLY
EPGXY-ADHESIVE, PHENOLIC-MOLDED, MELAMINE-MOLDED, POLYESTER-GLASS, NYLON, MOLYBDENU
EPUXY-CUMPOUND (7343-RESIN- 7139-CATALYST) FROM CREST PRODUCTS CO APCI-ING-NO
                   INSULATIONS FOAMGLAS (CELLULAR-GLASS) INSULATION, PITTSBURGH-CORNING INSULATIONS GLASS-WOOL APCI-1A3A-03 IP 2/21/72 INSULATIONS MINERAL-WOOL APCI-1A3A-04 IP 2/21/72
                                                                                                                                                                                                                                                                                          ENERGY RELEASE IN A LIQUID DXYGEN PUMP AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        EQUIPMENT FAILURE SHAKOPEE APCI-MEMO-68 06/12/68 2P
EQUIPMENT IN AIR PLANTS AND IN UXYGEN SERVICE APCI-PUM-SEC-1.08 7P PLUS 3P ATTA
EQUIPMENT COMMITTEE HELD AT FT/LAUDERDALE FLURIDA 5/11-12/71 LIQUID-UXYGEN PUMP
EQUIPMENT ERECTION UXYGEN COMPRESSION SYSTEM EL/SEGUNDO/CALIF APCI-CONSTR-SPEC-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 EQUIPMENT MALFUNCTIONS AND FAILURES GAS-PRESSURE-REGULATURS APCI-11F3A-1 3P 1/2 EQUIPMENT MALFUNCTIONS AND FAILURES COMPRESSORS AND PUMPS. APCI-11F3-4 15P 1/2 EQUIPMENT NEVER PREVENTS AN ACCIDENT- IT UNLY PREVENTS AN INJURY APCI-SAFETY-GREQUIPMENT SOLVENT MASHOUT-FREQUENCIES APCI-POM-SEC-5.07 3P 7/15/70
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         ESSO BEACON-325 APCI-IAIA-17 IP 2/21/72
ETHER EXTRACTABLE CONFAMINANTS AND FLUORESCENCE DAMCO-TEFLON TAPE, SANDEM-INDUSTRIA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  ETHYL-CHLUKIDE, DICHLORDETHAME, DICHLORDETHAME, TRICHLORDETHAME POLYMERS, POLYSULFI
EXCHANGER, PLANT, AND PLANT EQUIPMENT SOLVENT WASHOUT-FREQUENCIES APCI-PUM-SEC-5
EXPANDED PERLITE APL-ENGR-SPEC-N.01 3P 1/2/70
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         PP31-3
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  ETHYL-ALCOHOL, METHYL-ETHYL-KETONE, KEROSENE, GLYCERINE, POLYETHYLENE-LOW-DENSITY,
                                                                                                                                                                                                              ELECTRUFILM-SPRAYABLE-A, DRILUBE-I, TEFLON DISPERSION-T-FILM, HYDPOCARBON-GREASE, EL/SEGUNDG/CALIF APCI-CONSTR-SPEC-200.0 TO 200.20 20P 8/7/70
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     KM-246 APCI-ANAL-REP-70-013,70-014,70-015
APCI-ANAL-REP-70-026 APCI-IMG-NO-EA-7027
                                                                                                    INSULATIONS- MILFOAM MILFOAM CORP APCI-1A3A-06 IP 2/21/72
INSULATIONS- NATIONAL-GYPSUM-BLUE NATIONAL-GYPSUM CORP APCI-1A3A-07
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                9P PLUS APPENDIX I II III
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             EQUIPMENT- DELUGE-SYSTEM AND LOX LOADING FACILITY APCI-SAFETY-STD-630.2.6
EQUIPMENT- INSIDE- OUTSIDE APCI-SAFETY-STD-630.3.2 3P 5/68
EQUIPMENT- OUTSIDE FIRE-HYDRANT APCI-SAFETY-STD-630.2.2 IP 7/26/61
                                                                                                                                                                                          APCI-1434-02 IP 2/21/72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 4-A
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       PENNSALT-TECHNICAL-BULLETIN 6P 2/3/60
AND SUPPLIES APPROVED FOR USE IN APCI MANUFACTURING FACILITIES
CLEANED FUR DXYGEN SERVICE CGA-PAMPHLET-G-4.1 21P 3/59
FAILURE SHAKOPEE APCI-MEMO-68 06/12/68 2P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            EQUIPMENT- OUTSIDE HYORANT-HOUSE AND EQUIPMENT APCI-SAFETY-STD-630,2,3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       ATTCHMTS 7/1/71
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                                                                                                                                                      INSULATIONS- PERLITE APCI-1A3A-05 IP 2/21/72
INSULATIONS- TRANSITE, JOHNS-MANVILLE APCI-1A3
  APCI-144A-06
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              APCI-POM-SEC-1.17 8P 4/23/69
APCI-POM-SEC-1.17 8P 4/23/69
APCI-QUAL-CONT-LAYGUI-101F 2P PLUS 5P 0F
APCI-SAFETY-STU-630.2.3 3P REV-6/15/70
APL-SAFETY-BULL-102 1P 2/8/71
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SAFETY IN AIR AND
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                                                                                                                                                                                                                                                                       APCI-SAFETY-STD-626,3,8 8P
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ETHER-EXTRACTION GARLOCK-900, KM-226, KM-246
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        96
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ADHESIVES- VITON-A DUPONT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         2 p
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                                                                                                                                                                                                                                                                     EMERGENCY PROCEDURES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ESCAPE SYSTEMS
                                               ELECTRICAL
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                                                                                                                                                                                                                                   990003340 OXYGEN COMPRESSION SYSTEM
                                                                                                                                                                                                                                                                                                                                               990005530 AZARDS- SPILLS AND LEAKAGE 990000580 DS, AND EXPLUSION TESTING-
                   THERMAL AND
                                                                THERMAL AND
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990005700 L-HAZARDS- GXYGEN TRANSFER
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EXPLOSION HAZARDS- PLANT-WASH-OUT STUDY CELLULUBE-500, DTE 103, RECENT FIRES AT DUP EXPLOSION HAZARDS- PLANT-WASH-OUT STUDY CELLULUBE-500, DTE-103, CELLULUBE-200 RECEXPLOSION HAZARDS- PLANT-WASH-OUT STUDIES CELLULUBE-300, DTE-103, CELLULUBE-200 RECEXPLOSION OF CRYOSTAR-6B.114-PUMP-NO-C.75 AT CARFINGTON 2/17/71 AS REPORTED IN SAEXPLOSION OF LOX-PUMP ON TANKER-400-11 1/7/70 AT JUHN/SUMMERS STEEL WORKS/SHOTTO EXPLOSION ON OXY-FUEL-BUKNER EQUIPMENT ALCAN-BOOTH ALUMINIUM WORKS ROGERSTONE/EXPLOSION TESTING- EPON-H-60, POLYCEL-440R, AND STYRCFOAM, LUBRICANTS, MOLY-SPRAY-KEXPLOSION TESTING- FOUN-H-60, POLYCEL-440R, AND HAVEG GLASS-FIBER-REINFORCED PLASTIC EXPLOSION TESTING- IGNITION TEST-APPARATIOS, FLORUBE-GREASES, EPOXY COMPOUNDS DEVCON EXPLOSION TESTING- IGNITION TEST-APPARATUS, FLORUBE-GREASES, EPOXY COMPOUNDS DEVCON EXPLOSION TESTING- PINE AND MAPLE WOOD, ACTIVATED CARBON APCI-MAR-87-0-8821 1P EXPLOSION TESTING- POLYESTER RESIN IMPREGNATED FIBERGLASS LAVA APCI-MAR-87-0-882 EXPLOSION TESTING- SILICON-OILS UDM-CORNING-RF-EXPLOSION TESTING- SILICON-OILS UDM-CORNING-RF-EXPLOSION TESTING- SPARK-IGNITION, STANDARD BOMBS TEST, LED-PLATE-251, PIPE-DOPE A EXPLOSION TESTING- STANDARD PRESSURE BOMBS AND SPARK-IGNITION, SOW-CORNING FLUGRINA EXPLOSION TESTING- STANDARD IGNITION TEST METHOD, APL PIPING-RESIDUE, METHYLENE-CHL EXPLOSION TESTING- UCOM-TYPE LUBRICANTY TAKSET, PLASITE APCI-MAR-87-0-88 EXPLOSION TESTING- UCOM-TYPE LUBRICANTS, STEEL-PIPES APCI-MAR-87-0-8820 IP 4/61 EXPLOSIONS APCI-IIG-I 6P 11/1/71 HAZARDS- KEL-F-POLYMER, NYLON, CUTTING-OILS APCI-MAP-87-0-8822 IP 5/6 HAZARDS- OXYGEN-PRESSURF-GAUGE TWF WGOL, SPINTEX-305, MOLYKOTE-TYPE-Z AND HAZARDS- PLANT-WASH-OUT STUDIES CELLULUBE-300 CELLULUBE-220 APCI-MAR-87 EXTRACTABLE CONTAMINANTS AND FLUORESCENCE DAMCO-TEFLON TAPE, SANDEM-INDUSTRIAL, CRA EYE PRUTECTION APCI-SAFETY-STD-627.4.2 5P 10/62 HAZAROS- HALUCARBUN, MOLYLUBE-99, MOLYKOTE-TYPES-Z AND X-15, CABUSIL-M-5 AND TANKER FIRE AT SHEEPBRIDGE ALLOY CASTINGS LTD APL-MEMO-64 02/5/ AT STOKE PLANT 8/1/70 APL-SAFETY-DEPT-REP-34 14P 8/24/70 AND FIRE OCCURRED IN BURCKHARDI CENTRIFUGAL LOX-PUMP-TYPE-GB114-NO-29224 AND FIRE DUE TO THE CRYDSTAR-GBILG LOX-PUMP ON AN SSPC LOX-TANKER APCI-MEMD-63 10/21/63 APCI-SAFETY-GRAM-NO-O1 1P 6/1/61 APCI-MEMIJ-70 06/26/70 3P MCA-CASE-HISTORY-NO-824 AIRCU-BUTLER **EXPLOSIONS** EXPLOSION EXPLOSION EXPLOSION EXPLOSION EXPLOSION 2/26/69 WHEN AN EXPLOSION EXPLOSION **EXPLUSION** ASSOC INC LIQUID-DXYGEN EXPLOSION SSES SAVE ANOTHER PAIR OF EYES AND AND FLAMMABILITY AND APCI FLAMMABILITY AND APCI FLAMMABILITY AND AND AND AND ONA ONA AND AND AND LOX-PUMP FIRES AND TEFLON TAPE PERCENT ETHER NNEL-PROTECTIVE-EQUIPMENT-990002610 PCI REPORT OF GXYGEN PUMP ATTON OF CRYDSTAR LCX-PUMP 990003940 EVERSON,I. APL REPURT ON 990005890 NAYLOR,R. APL REPORT ON UNCKHARDI CENIRIFUGAL PUMP FLAMMABILITY AND COMMENDATIONS ARISING FROM EVERSON, I. APL EVERSON, I. APL SAFETY, HAZARDS, FLAMMABILITY SAFETY, HAZARDS, SAFETY, HAZARDS, SAFETY, HAZARDS, SAFETY, HAZARDS, ATIONAL-HAZARDS- FIRES SAFETY, HAZARDS, SAFETY, HAZAKDS, FLAMMABILITY SAFETY, HAZARDS, SAFETY, HAZAKDS, SAFETY, HAZARDS, SAFETY, HAZARDS, SAFETY, HAZARUS, PLANT PHERO,N. APCI APCI APCI APCI APCI APC I APC I APCI APCI APCI APC1 990005880 TE 011200066 099000066 990000626 99000Cc 70 065000066 990005750 990003100 071500089 990004210 056500066 990000730 027000069 002000065 04/000066 990003950 09600066 049000066 069000056 069000066 019000066 002000066 990002580 990001150 076800066 002000066 089000066 009000066 99000066

FAILURE OF BRAZED JOINTS IN HIGH-PRESSORE GASEUUS OXYGEN-LINE AT A CYLINDER FILLIN FAILURE SAFETY GLASSES SAVE ANOTHER PAIR OF EYES APCI-SAFETY-GRAM-NO-01 IP 6/1 FAILURE SHAKOPEE APCI-MEMO-68 06/12/68 2P FAILURE SHAKOPEE APCI-MEMO-68 SAFETY IN AIR AND AMMONIA PLANTS V-9 P5 196 FAILURES GEISERING, EXCESSIVE VIBRATIONS, SHUCK (THERMAL AND PRESSURE), LINE-SURG FAILURES IN PRESSURE-VESSELS AND PIPING REINHOLD PUBLISHING CORP 427P 1965 FAILURES INSULATION SYSTEM DUE TO VIBRATIONS DETERIORATION APCI-IIF3C-1 IP 12 990001400 NING-4X COMPOUND-SILICONE, FAIRBANKS-SILICONE-DC-44, MGRSE GREASE, ALPHA-CORP-MGLYKOTE-MICRGSIZF, MGNSANTO-PYD FATIGUE CRACK GROWTH-RATES AND FRACTURE TOUGHNESS STUDY OF WELDED ALUMINUM ALLOY-5 THE MINIMUM STAMDARDS FEDERAL REGISTER TIME FOR CONFIRMATION OF REVISION OF MAXIMU MEAN STRESS ON FATIGUE CRACK-PROPAGARION IN PLATES UNDER EXTENSION AND BENDING ASME WINTER FAILURES APCI INCIDENTS INVOLVING DXYGEN-TRANSFER-EQUIPMENT OR INSTRUMENTATION APC 1-11F3-6 FAILURE APCI-MEMO-67 12/29/67 1P FAILURE APCI-SAFETY-GRAM-NO-13 2P 6/1/62 FAILURE INCIDENTS WHICH GCCURRED WITH OTHER OXYGEN-EGUIPMENT APCI-GUAL-CONT-LAYOUT-103F 11P REV 12/14/65 APCI-SAFETY-GRAM-NC-35 IP 10/4/63 5/8/64 GAS BY PIPELINE— MINIMUM FEDERAL SAFETY—STANDARDS ESTABLISHMENT UP GAS BY PIPELINE— MINIMUM FEDERAL SAFETY—STANDARDS EXTENSION UF TIM APCI-11F3-1 1P 11/12/71 APCI-SAFETY-GRAM-ND-43 RE-99000301 FACILITIES FA 11 URES FAILURES FAILURES FAILURES 990003840 LLUTI,E. EVERSON,I. APL 990003170 APCI PRESSURE-GAUGE 990002840 APCI TEST GAUGE EQUIPMENT 990002640 H. APCI OXYGEN PIPE-LINE 990000050 W. APCI OXYGEN CYLINDER 990002850 USE IN APC! MANUFACTURING 990005690 -TRANSFER MALFUNCTIONS AND 990003010 AIRCL LIQUID DXYGEN PUMP 990005670 N-TRANSFER MALFUNCTION AND 990000110 ERINGH APCI VACUUM PUMP 990000120 M.W. APCI PRESSURE GAUGE 990005630 N-TRANSFER MALFUNCTION AND 990005750 -TRANSPER MALFUNCTIONS AND 990003490 GKINNELL CO DEFECTS AND 990005740 -TRANSFER MALFUNCTIONS AND 9900C2630 AIRCO LIGUID GXYGEN PUMP RUBERTS, R. LEHIGH UNIV 990005160 990003570 990063510

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990003030 AZARD LEVEL OF HYDROCARBOD FILMS IN SYSTEMS CUNTAINING LIQUID AND GASEOUS DAYGEN USAF-CONTRACT—AF33(16)6 990003030 AZARD LEVEL OF HYDROCARBOD FILMS IN SYSTEMS CONTAINING LIQUID AND GASEOUS DAYGEN ADVANCES IN CRYGGENIC 990001990 AZARD LEVEL OF HYDROCARBOD FILMS IN SYSTEMS CONTAINING LIQUID AND GASEOUS DAYGEN ADVANCES IN CRYGGENIC 990001900 ZARU LEVEL OF HYDROCARBOD FILMS IN OXYGEN SYSTEMS AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLAN APCI DAYGEN COMPRESSOR FILTER ASSEMBLY APCI-DRAWING-5852LC KEVB 12/18/57 APCI-DIA APCI DAYGEN TRAILER FIRE AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS V-4 PP49-50 19 990002990 KGS CO GXYGEN TRAILER FIRE AT SHEPBRIDGE ALLUY CASTINGS LTD APL-MEMO-64 02/5/64 16P 990004290 RCKHARDI DAYGEN COMPRESSOR FIRE AT SHEPBRIDGE ALLUY CASTINGS LTD APL-SAFETY-BULL-107 3P 4/14/71 PY00003860 RCKHARDI DAYGEN COMPRESSOR FIRE AT SPEC ROGING PLANT 3/2/71 APL-SAFETY-BULL-107 3P 4/14/71 PY00003860 RCKHARDI DAYGEN COMPRESSOR FIRE AT SPEC ROGING CLEANING WITH TRICHLORDETHYCENE (T.C.E.) APL-SAFETY-DEPT 9900003860 RCKHARDI DAYGEN COMPRESSOR FIRE AT SPEC ROGING CLEANING WITH TRICHLORDETHYCENE (T.C.E.) APL-SAFETY-DEPT 9900003860 RCKHARDI DAYGEN CHARDI DAYGEN CLEANING WITH TRICHLORDETHYCENE (T.C.E.) APL-SAFETY-DEPT 9900002590 A-66. LINDE ASPECTS OF FIRE IN GXYGEN-LINE APCINCAGEN DOWN THE HUMAN ASPECTS OF FIRE IN GXYGEN-LINE APCINCAGEN DOWN FIRE AD GXYGEN-LINE APCINCAGEN DOWN FIRE AD GXYGEN-LINE APCINCAGEN DOWN FIRE AD GXYGEN-LINE APCINCAGEN DOWN FIRE AND GXYGEN-LINE APCINCAGEN DOWN FIRE AND GXYGEN-LINE APCINCAGEN DOWN FIRE AND GXYGEN-LINE APL-SAFETY-GRAM-NO-05 IP 10/20/61 AND AND FIRE IN GXYGEN-LINE APCINCAGEN DOWN FIRE AD GXYGEN-LINE APCINCAGEN DOWN FIRE AND GXYGEN-LINE APCINCAGEN DOWN FIRE AND GXYGEN-LINE APCINCAGEN DOWN FIRE AD GXYGEN-LINE APCINCAGEN DOWN FIRE AND 
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SAFETY-STANDARDS FILING OF INSPECTION AND MAINTENANCE PLANS FEDERAL REG
SAFETY-STANDARDS FOR GAS PIPELINES CORROSION-PITTING- NOTICE OF PUBLIC HEA
SAFETY-STANDARDS MISC AMENDMENTS FEDERAL REGISTER V-35 N-223 11/17/
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PROTECTION EQUIPMENT— OUTSIDE FIRE—HYDRANI APCI—SAFETY—STD—630.2.2 IP 7/2
PROTECTION EQUIPMENT— OUTSIDE FIRE—HYDRANI APCI—SAFETY—STD—630.2.2 IP 7/2
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FIRE CCCURRED IN BURCKHARDT CENTRIFUGAL LUX-PUMP-TYPE-CBI14-NO-29224 APL-SAFETY-
FIRE PROTECTION CGA AIR-SEPARATION PLANT SAFETY SYMPOSIUM PP175-134 10P
FIRE RISKS TU. MAN OF GXYGEN RICH GAS ENVIRONMENTS FPRC/MEMO-223 12P 7/65
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FIRE-COMPATIBILITY, QUALITY-CONTROLL-APCI APCI-IBID(2)-1 3P 9/9/71
FIRE-COMPATIBILITY, QUALITY-CONTROL, FIRE HAZARDS APCI-IBID(1)-1 2P 9/9/71
FIRE-CKMPATIBILITY, AUALITY-CONTROL, FIRE HAZARDS APCI-IBID(1)-1 2P 9/9/71
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                                                                                                                                                                                                                                                                                                                                                                                                          FIBERIZED MINERAL WOOL INSULATION APCI-QUAL-CONT-LAYOUT-103L 2P 7/1/71
FIELD INSPECTION CONTRACT WITH MARYLAND. CASUALTY CO. APCI-POM-SEC-6.09-ATTCH
FIELD FABRICATED CRYDGENIC LIQUID STORAGE TANKS APCI-IIFI-3 1P 2/3/72
FIELD FABRICATED FLAT-BOTTOM LOX STORAGE TANKS APCI-IIA4-2 1P 12/30/71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      FIRE INCIDENT IN AN UXYGEN CLOUD FIRE JOURNAL PP76-8 AND 81 4P 1/71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    FIRE-PROTECTION EQUIPMENT- DELUGE-SYSTEM AND LOX LOADING FACILITY
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       EXTINGUISHMENT APCI-SAFETY-STD-635.30 SP 2/68
HAZAROS APCI-IBID(1)-1 2P 9/9/71
HAZARDS IN COMPRESSEO-AIK AND OXYGEN RICH ENVIRCHMENTS
                                                                                     CAS BY PIPELINE- MINIMUM FEDERAL SAFETY-STANDARDS MISC AMENDMENTS FEDERAL REGISTE UAS BY PIPELINE- MINIMUM FEDERAL SAFETY-STANDARDS ODORIZATION OF GAS FEDERAL REGISTORS BY PIPELINE- MINIMUM FEDERAL SAFETY-STANDARDS REQUIREMENTS FOR CORROSION CONTROL
                                                                                                                                                                                                                                                                                                                 APCI-DES-ENG-STD-581.2 2P. 6/26/69
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      1ERS APC1-PUM-SEC-1,13 5P 3/30/67
APC1-SAFETY-SID-630,2,2 1P 7/26/61
                                                                                                                                                                                                                                                                                                                                                         APCI-MAR-87-0-8821 1P 3/62
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           PRUTECTION EQUIPMENT- INSIDE- OUTSIDE
                                                                                                                                                                                                                                                      990002310 VENTIVE MAINTENANCE REPORT FEEC-BACK-CARD FORM-3610A
                                                                                                                                                                                                                                                                                                                 FIBER GRANULATED
                                                                                                                                                                                                                                                                                                        990000400 CLD-INSULATION AND MINERAL FIBER GRANULATED 990000570 LYESTER RESIN IMPREGNATED FIBERGLASS LAVA.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       FIRE-HYDRANT
                                                          FEDERAL
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FIRE
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                                                                                                                                                                                                                                                                                                                                                                                                      990001310 U ESTABLISH ACCEPTANCE OF 990002050 RYLAND CASUALTY CO APCI 990005580 TRANSFER SYSTEMS SYSTEMS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               990005430 RE INTEGRITY OF INSULATION
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ANDARD SPECIFICATION FOR A
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          AZARD LEVEL OF HYDROCARBON
                                                          NINI SOL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        990005330 TIBILITY, QUALITY-CONTROL,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               990004240 ENGLAND ASSESSMENT OF THE 990003380 6769 WHEN AN EXPLOSION AND
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               990005340 LITY, COMPATIBILITY CHECK,
990005330 LITY, COMPATIBILITY CHECK,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        M FEDERAL SAFETY-STANDARDS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           FLEET SAFETY-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               990005350 LITY, COMPATIBILITY CHECK,
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       990002440 TECTION EQUIPMENT- OUTSIDE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       990002690 GENER, W. WINDGASSEN, K.F.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               HUBBS,M.H. APCI
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              EVERSON, I. APL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     APCI
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       SMI TH, H.
                                                          SAFETY
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FLUGRGGREEN-E-600 APCI-IAZA-II 2P 2/21/72

FLUGRGGREEN-E-600 APCI-MEMO-70 10/23/70 1P

FLUGRGGREEN-E-600, JGHN/JORE CJ APCI-MEMO-63 07/30/6.

FLUGRG-GLIDE FLAMMABILITY IN 100-PERCENT GASEGUS CXYGEN APCI-ANAL-REP-61-262

FLUGRG-GLIDE, CHEMPLAST INC APCI-IAJA-14 1P 2/21/71

FLUGRGLUBE SEARS-THREAU-CUTTING-OIL APCI-ANAL-REP IP 7/15/71

FLUGRGLUBE-FSS, KEL-F-LF3, VERSILUBE-F-50, SFB1(40)-SILICONE, PYDRAUL-F-9, DGW-CGRN FLUGRGLUBE, FS-5, HOOKER CHEMICAL APCI-IAJA-11

FLUGRGLUBE, FS, HOOKER CHEMICAL APCI-IAJA-11

FLUGRGLUBE, FS, HOOKER CHEMICAL APCI-IAJA-07 10 2/21/72 FLAMMABILITY AND EXPLOSION HAZARDS- PLANT-WASH-DUT STUDY CELLULUBE-300, DTE 103, RE FLAMMABILITY AND EXPLOSION HAZARDS- KEL-F-POLYMER, NYLUN, CUTTING-GILS APCI-MAR-B FLAMMABILITY AND EXPLOSION HAZARDS- PLANT-WASH-UUT STUDIES CELLULUBE-300 CELLULUBE-FLAMMABILITY AND EXPLOSION HAZARDS- HALGCARBON, MOLYLUBE-99, MOLYKOTE-TYPES-Z AND FLAMMABILITY AND EXPLOSION HAZARDS- PLANT-WASH-DUT STUGIES CELLULUBE-360, DTE-103, FLAMMABILITY AND EXPLOSION HAZARDS- DXYGEN-PRESSURE-GAUGE TWF WOOL, SPINTEX-305, MG 990GG150 FASTERNINGS AND FLUORESCENCE DAGGO-TEFLON TARE, SANDEM-INDUSTRIAL, CRANE PACKING CO APCI-ANAL-R 990GG1110 TEGGATE CONTAINANTS AND FLUORESCENCE OF VARIOUS TYPES OF OILS-MUBIL-DIE-105 TEACG-CAPPELLA-AA CELLULUBE-5 990GG1110 L.G. APCI APCI FLUORESCENCE OF VARIOUS TYPES OF OILS-MUBIL-DIE-105 TEACG-CAPPELLA-AA CELLULUBE-5 990GG1110 L.G. APCI APCI FLUORIGE, POLYDIMETHYLSILOXANE, ELUSTINATED-SILOXANE, ELUSTINATED-SILOXANE, ELUSTINATED-SILOXANE, ELUSTINATED-SILOXANE, ELUSTINATED-SILOXANE, LS-53, BUTYL-KUBBER, IRON-UXIDES, TALC, ASBESTOS, ALUMINUM-CH 990GG1890 IDE, POLYDIMETHYLSILUXANE, FLUORIGARBGN-TAPE, THREE-M-FLUORIGARBGN-TAPE, PERMACEL-TAPE APCI-MEMO-63 07/30/63 990GG4570 KEADING COMPOUNDS- THREE-M FLUORIGARBGN-TAPE APCI-IAZA-11 2P 2/21/72 SANDING COMPOUNDS- THREE-M FLUORIGARBGN-TAPE APCI-IAZA-11 2P 2/21/72 SANDING COMPOUNDS- THREE-M FLUORIGARBGN-TAPE APCI-IAZA-11 2P 2/21/72 SANDING COMPOUNDS- THREE-M FLUORIGARBGN-TAPE APCI-MEMO-70 10/23/70 1P FIRES AT OURDINT-NEW JOHNSONVILLE-PLANT TITANIUM, TITANIUM-DIOXIDE, SCLNUS-500, HYDR FIRES AT DUPONT-NEW JOHNSONVILLE-PLANT SCLNUS-500, TITANIUM-TETRACHLORIDE APCI-MA FIRES AT TEXAS INSTRUMENTS LTO-BEOFORD APL-SAFETY-DEPT-REP-31 5P REV-1 2/11/ GASEOUS DXYGEN FOAMSEAL-30-45-LIQUID, FOAMSEAL-30-45 FLEET SAFCTY- FIRE EXTINGUISHMENT APCI-SAFETY-STD-635.30 5P 2/68
FLEET SAFETY- LOADING AND UNLDADING OPERATIONS APCI-SAFETY-STC-635.19 6P 2/68
FLEXFAS-82-10-DRY, SFALFAS-MASTIC-31-97-LIQUID, SFALFAS-MASTIC-31-97-DRY, PITTSEALFLEXFAS-82-10-LIQUID, FLEXFAS-82-10-DRY, SFALFAS-MASTIC-31-97-LIQUID, SFALFAS-MASTI FLEXIBLE HOSES FOR CHARGING AND DISCHARGING MANIFOLOS OXYGEN SERVICE APL-ENGR-FLOCR TREATMENT WEST CHEMICAL PRODUCTS: INC, ALUMINUM-OXIDE, SEAM COMPOUND GEON POFLORUBE-GREASES, EPOXY COMPOUNDS DEVCON-2-TON AND DEVCON-F, FUAM-TYPE INSULATIONS SFLOW-METER RING SEAL-FLUID APCI-MEMO-70 02/27/70 IP APCI-IWO-NO-1 FLAMMABILITY TESTS ON INSULATION MATERIALS VASCOCEL MILFDAM NATIONAL-GYPSUM (GREEN FIRES AT TEXAS INSTRUMENTS LTO-BEDFORD APL-SAFETY-DEPT-REP-31 5P REV-1 2/11/ FITTINGS, CLEANING ALUMINUM-PIPE FITTINGS PARTS AND FABRICATIONS, CLEANING STAINL FLAMMABILITY TEMPERATURE APCI-MEMO-59 12/11/59 1P FLAMMABILITY TEST OF GASKETS IN OXYGEN ATMOSPHERES JOHN-DORE-CO, MELRATH-GASKET-C FORMBLIN-YO4 MONTECATINI-EDISON APCI-IAIA-18 1P 2/21/72 FURMICA-LAMINATE BUNDED WITH A PHENULIC RESIN, CUTTING-OILS, HEXADECANE, HYDROCARB FGAM-TYPE INSULATIONS STYROFDAM AND POLYURETHANE-FGAM-INSULATION, RAYBESTOS-MANHATT FUAMSEAL-30-45-DRY, FLEXFAS-82-10-LIQUID, FLEXFAS-82-10-DRY, SEALFAS-MASTIC-31-97-L FOAMSEAL-30-45-LIQUID, FOAMSEAL-30-45-DRY, FLEXFAS-82-10-LIQUID, FLEXFAS-82-10-DRY, MINTER ANNUAL-MEETI APCI-ANAL-REP-61-262 1P 4/11/61 FUAM-GLASS LIQUID-HYDRUGEN-PIPING-SYSTEMS LNG-SYSTEMS INERT-CRYGENES BELOW THE APCI-143A-01 APC 1-MAR-87-0-8821 V-8 APCI-IWO-NU-LA-0333 APCI-MEMD-68 10/24/68 2P GASEGUS OXYGEN APCI-ANAL-REP-61-435 PLANIS INSULATION, PITTSBURGH-CORNING CORP ASME AMMON I A FDAM GLASS APCI-ANAL-REP-61-034 TO 61-40 AND 61-42 FDAM INSULATION, AND HAVEG GLASS-FIBER-REINFORCED PLASTIC FRACTURE TOUGHNESS STUDY OF WELDED ALUMINUM ALLOY-5083 FGAM (EPCN-FGAM-H-60) APCI-MAR-87-0-8820 1P 8/61 SAFETY IN AIR AND ď 06/26/70 6P APCI-IIG-1 6F APCI-MEND-70 AICHE-CEP-TECH-MANUAL 100-PERCENT 100-PERCENT 100-PERCENT FOAMGLAS (CELLULAR-GLASS) FIRES AND EXPLOSIONS FIRES AND EXPLOSIONS FOAM-GLAS (CORNING) FLAMMABILITY IN FLAMMABILITY IN FLAMMABILITY IN OPERATIONAL -HAZARDS-TTINI, d. J. APCI LOX-PUMP 990000750 ULUBE-300, DTE 103, RECENT 990003910 PL INVESTIGATION CF VALVE G OF CARBON STEEL PIPE AND 990001300 14UID, FOAMSEAL-30-45-DRY, 990000740 -103, CELLULUBE-200 RECENT 990001120 ALYSIS FUR UIL CONTENT AND 990001300 DRY, FLEXFAS-82-10-LIQUID, 990001110 /NEW/JERSEY, WEST CONCRETE 9900006LO - IGNITION TEST-APPARATUS, APCI OXYGEN 990004760 PCI GASKETS AND PACKINGS-S-Z AND X-15, CABUSIL-M-5 GROWTH-RATES AND SEALING MATERIALS-FLUCRO-GLIDE APCI LUBRICANTS-UCCN-HB660, AURALUBE-FS, APCI LUBRICANTS-M NATIONAL-GYPSOM (GREEN) DEVCON-2-TON AND DEVCON-F. EN FOAMSEAL-30-45-LIQUID, UXUMAT -CAPPELLA-AA CELLULUBE-550 LUBRICANTS-590000600 N-GILS, SHELL POLYURETHANE I NSUL AT I DNS -PURCUS-INSULATING-MATERIAL AL-CYPSUM-BLUE LOX-SYSTEMS APCI APCI APCI 990000690 EXPLUSION TESTING- HOUDRY O-PERCENT GASEOUS DXYGEN APCI APCI APCI APCI APCI APCI APCI APCI PEGRAM, J.W. WALDE, R. A. YUDER, L. KITSON, F.K. SAFETY-VALVE-SEAT MALUE, R. A. MALDE, K.A. MALDEY N. A. MALUE, R. A. SCHMAUCH, 6. E. WALDEOROAS 996001350 DER, L. APCI 990002730 MASTER, H.H. D ELECTRICAL 990002160 UE CRACK 990005750 APCI 029700066 085700066 020100066 042000066 071000066 990000760 990000130 052000066 000100066 990001460 990002930 026100066 091500066 011600066 990001460 990001300 990004590 990002930 990002920 009000066 006100066 990001300 990000730 011000066 990001210 056100066 056100066 990064390 990004350 990004420

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INDS. GARLOCK-900 JOHNS-HANNILLE "ASSESTOS-61 JOHNS-CARLOCK-900 JOHNS-HANNILLE "ASSESTOS-61 JOHNS-CARLOCK-900 JOHNS-HANNILLE "ASSESTOS-61 JOHNS-CARLOCK-900 JOHNS-HANNILLE "ASSESTOS-61 JOHNS-LANDILLE "APCI-ANAL-REP-70-013,70-014,70-015 APCI-123 APCI-LOUG GARLOCK-900 JOHNS-HANNILLE "APCI-ANAL-REP-70-013,70-014,70-015 APCI-123 APCI-LOUG GARLOCK-900 JOHNS-HANNICK "RFAN-NOT-51 BP 1969 AND CUTTING AND WELDING MELDING MELDING SYSTEMS ANSI-B31.8 JOBP 1968 AND CUTTING AND WELDING AND WELDING SYSTEMS ANSI-B31.8 JOBP 1968 AND CUTTING AND WELDING AND WELDING SYSTEMS AND CONTRICTED COPPLIED TO PER-HANN-V-1-SEC-4.1.3 2P 6/71 APCI GASEUUS GXYGEN APCI-234.FTT-GARM-NOD-23.6 P 11/36.9 APCI -FREMC-63 06/11/63 1P APCI GASEUUS GXYGEN COMPATIBILITY TEST UN MOLY-LUBE-NU-99 APCI -FREMC-63 06/11/63 1P APCI GASEUUS GXYGEN COMPATIBILITY TEST UN MOLY-LUBE-NU-99 APCI -FREMC-63 06/11/63 1P APCI GASEUUS GXYGEN COMPATIBILITY OF GASEUUS GASEUUS GXYGEN COMPATIBILITY OF GASEUUS GASEUUS GASEUUS GXYGEN COMPATIBILITY OF GASKEUT MATERIAL WITH GASCUUS GASEUUS GA
                          S, AND SUPFACE TREATMENTS- FREE-MACHING BRASS APCI-1A6A-24 2P 2/21/72
ND SEALER- TAPE-SEAL FROM FRIESLAND-PLASTIC COMPANY, PERMACEL-TAPE APCI-ANAL-REP-60-495,61-3 APCI-IMO-NO-
1 LUBRICANTS- FLUORDLUBE, FS-5, HOUKER CHEMICAL APCI-IAIA-11 IP 2/21/72
1 LUBRICANTS- FLUORDLUBE, FS, HOUKER CHEMICAL APCI-IAIA-07 IP 2/21/72
1 LUBRICANTS- FLUORDLUBE, FS, HOUKER CHEMICAL APCI-IAIA-07 IP 2/21/72
1 PMENT COMMITTEE HELD AT FIZLAUDERDALE FLORIDA 5/11-12/71 LIQUID-DXYGEN PUMPS ALUMINUM IN UXYGEN SERVICE L
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               GERMAN NATIONAL, STANDARDS COMPOSITION 5-PERCENT-CR 17-PERCENT-N1: 4-PERCENT-CU GERMAN PRESSURE VESSEL CODE-AD.MEKKBLATTE? (ENGLISH TRANSLATION) 304P 9/71 GLASS APCI-ANAL-REP-61-034 TO 61-40 AND 61-42 APCI-IMO-N0-10-0589 IP 2/3/61
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       GASKETS IN OXYGEN ATMUSPHERES JOHN-DORE-CO, MELKATH-GASKET-CO, VALLEY-FORGE-GASKE
GAUGE EQUIPMENT FAILUNE SHAKOPEE APCI-MEMO-68 06/12/68 2P
GAUGE FAILURES. APCI-SAFETY-GRAM-NO-43 2P 5/8/64
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         GEISERING, EXCESSIVE VIBRATIONS; SHUCK (THEEMAL AND PRESSURE), LINE-SURGES APC.
GEON POLYVINYLCHLORIDE, PLASTIC LEAD SEAL-NO-2-JOHN CRANE - APCI-MEMO-59 01/28/59
                                                                                                                                                                                                                                                                                                                                                                                                                              APCI-145A-07
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GE THERMOLITE-12-CURING-CATALYST APCI-1A4A-01 1P 2/21/72
         DESIGN IN CRYDGENIC PRESSURE-VESSELS
                                                                                                                                                                                                                                                                                                                              990003690 HEET PACKING STYLE-NJ-61 GARLGCK-900 APCI-IMO-ND-LB-0795 APCI-ANAL-REP-71-264 2P 5/28/71
990003100 OMPATIBLE GASKET MATERIALS GARLGCK-900 DURABLA JOHNS-MANVILLE ASBESTOS SHEET PACKING STYLE-61
990004790 PCI GASKETS AND PACKINGS- GARLGCK-900 (SHEET-ASBESTOS GASKET MATERIAL) GARLGCK MFG CD APCI
                                                                                                                                                                                                                                                                                                          APCI-ANAL-REP-70-026 APCI-IWO-NU-EA-7027 2P 1/30/70 APCI-IWO-NU-LB-0795 APCI-ANAL-REP-71-264 2P 5/28/71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   GASKETS AND PACKINGS - VULCANIZED-RED-FIBRE-GASKETS
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                                                                                                                                                                                                                                                                      APCI-1454-07 1P 2/21/72
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                                                                                                                                                                                                                                                                                                       APCI-ANAL-REP-70-026
   FRACTURE-MECHANICS TO SAFE-LIFE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               GAUGE-FAILURE
                                                                                                                                                                                                                                                                                                       GARLUCK-900
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         990000410 CCLU-bOXES, THERMAL TANKS, GLASS WOOL
                                                                                                                                                                                                                                                                                                       T ETHER-EXTRACTION MELRATH
                                                                                                                                                                                                                                                                                                                                                                                                                                                  990003040 (GREEN) VITON-A (BLACK)
990601420 D SOXHLET ETHER-EXTRACTION
990002420 D UPERATION OF OXYGEN-FUEL
APPLICATION OF
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               ALLOY TO DIN
MERKBLATTER
                                                                                                                                                                                                                                                                  ASBESTOS GASKET MATERIAL!
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       990003550 DERAL SAFETY-STANDARDS FOR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               990001920 IREMENTS FOR CUSTOMER BULK
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              990005970 ATERIALS COMPATIBILITY FOR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         PRESSURE-VESSELS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                990005710 MALFUNCTIONS AND FAILURES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               990001370 TESTS WITH SILICONE-RUBBER
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 990001390 ATERIAL, JOHNS-MANVILLE-76
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                990000120 AUYER, W. W. APCI PRESSURE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  MALFUNCTIONS AND FAILURES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       MINUM-CALDE, SEAM COMPOUND
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GRANULATED APCI-DES-ENG-STD-SBI.2 2P 6/26/69
GRAPHITE IMPREGNATED ASBESTUS-PACKING TEFLUN CUATED ASBESTUS-BLUE APCI-MEMO-60
GRAPHITE IMPREGNATED ASBESTUS-PACKING TEFLUN CUATED ASBESTUS-BLUE APCI-MEMO-60
GRAPHITE-CHLUR-BIPHENYL, VINYL-CHLORIDE, CIS-UICHLCRUETHYLENE, TRANS-DICHLGRÜETHYLE
GRAPHITE, ELECTROFILM-SPRAYABLE-A, DISLUBE-I, TEFLUN DISPERSIUN-T-FILM, HYDROCARBON
GREASE, ALPHA-CORP-MOLYKOTE-MICROSIZE, MÜNSANTU-PYDRAUL, GULF-MECHANISM-HYDROCARBON
GRATI-LACAD-PRIMER, SHERWIN-WILLIAMS-E41A4, SUPEKFLAKE-1822, SUPERIOR-GRAPHITE-CO, CA
GUIDELINES AND TEST DATA-HANDBOOK MSC-02081 380P 5/29/70
GULF-MECHANISM-HYDROCARBON, HAVOLINE-HO-HYDRUCARBUN, SHELL-2-1176-A-HYDROCARBON, IN HANTS ENCLAND ASSESSMENT UF THE FIRE RISKS OF THE COXYGEN ENVIRONMENT EXPERIME HANTS ENCLAND FIRE RISKS TO MAN OF COXYGEN RICH GAS ENVIRONMENTS FPRC/MEMU-2 HANTS ENGLAND FURTHER STUDIES UPON THE HUMAN ASPECTS OF FIRE IN ARTIFICIAL GAS HARD HATS APCI-SAFETY-SIO-627.4.1 IP 6/15/70

HATTINGEN PAINT 15P APPENDIX I II III BOXED HAZARD LEVEL OF HYDROCARBON FILMS IN SYSTEMS CONTAINING LIQUID AND GASEOUS OXYGE HAZARD LEVEL OF HYDROCARBON FILMS IN SYSTEMS CONTAINING LIQUID AND GASEOUS OXYGE HAZARD LEVEL OF HYDROCARBON FILMS IN OXYGEN SYSTEMS APL-SAFETY-DEPT-INFO-SHEET-HAZARD LEVEL UF HYDROCARBON FILMS IN OXYGEN SYSTEMS APL-SAFETY-DEPT-INFO-SHEET-HAZARD WHEN VAPOUR CLEANING WITH TRICHLOROETHYLENE (T.C.e.) APL-SAFETY-DEPT-INFO HAZARDS APCI-SAFETY-GRAM-NG-49 2P 3/26/65 APRICED PROBLEMS RELATED TO OXYGE HAZARDS PROTECTION APL-BULLETINS AND REPORTS ON VARIOUS PROBLEMS RELATED TO OXYGE HAZARDS HALOCARBON, MOLYLUBE-99, WOLYKOTE-TYPES-Z AND X-15, CABUSIL-M-5 FORMICA-L HAZARDS-HALOCARBON, MOLYLUBE-99, WOLYKOTE-TYPES-Z AND X-15, CABUSIL-M-5 FORMICA-L HAZARDS-DLANT-WASH-OUT STUDIES CELLULUBE-3005, MOLYKOTE-TYPE-Z AND TYPE-X-1 HAZARDS-PLANT-WASH-OUT STUDIES CELLULUBE-3005, CELLULUBE-220 APCI-MAR-87-0-8822 IN AZARDS-HAZARDS-DLANT-WASH-OUT STUDIES CELLULUBE-3005, CELLULUBE-220 APCI-MAR-87-0-8822 IN AZARDS-DLANT-WASH-OUT STUDIES CELLULUBE-300 CELLULUBE-220 HAZAROS- PLANT-WASH-OUT STUDY CELLULUGE-300, DTE 103, RECENT FIRES AT DUPONT-NEW/JO HAZAROS- SAFETY INFORMATION RELATIVE TO LIQUID-VAPUE-CLOUDS APCI-PAPES 7P 1971 HAZAROS, AND EXPLOSION TESTING- SILICON-CILS DUM-CURNING-RF-1-0065, SILICON-DILS DO HAZARDS, AND EXPLOSION TESTING- SPARK-IGNITION, STANDARD BOMB TEST, LED-PLATE-251, HAZAROS, AND EXPLOSION TESTING- UGGN-TYPE LUBRICANTS, STEEL-PIPES APCI-MAR-87-0-8 GLASS-COTTON-ALUMINIZED-MIL-C-8240, COCOTITE-CEPAMIC-INSULATION, CHROMATE-DYED-GLAS GLYCERINE, POLYETHYLENE-LUW-DENSITY, POLYETHYLENE-IRRAGIATED, POLYVINYLCHLORIDE, PO EXPLOSION TESTING- STANDARD PRESSURE HOMBS AND SPARK-ISNITION, DOW-COR HALGCARBON, MOLYLUBE-99, MOLYKOTE-TYPES-2 AND X-15, CABUSIL-M-5 FORMICA-LAMINATE HAND VALVE-CODE APCI-DES-ENG-STD-579,3 12P 1/63 HALOCARBON-25-5S-GREASE, HALOCARGON PRODUCTS CORP APCI-IAIA-06 1P 2/21/72 HALOCARBON-6-25-WAX, HALOCARBON PRODUCTS CORP APCI-IAIA-04 1P 2/21/72 APCI-IAIA-03 IP 2/21/72 APCI-IAIA-02 IP 2/21/72 6/1/61 APCI-SAFETY-GRAM-NO-01 1P APCI-MAR-87-0-8321 IP 6/62 2/21/72 2/21/72 2/21/72 2/21/72 ď APCI-MEMU-69 02/6/69 1P GRANITE/CITY APCI-MEMO-67 12/15/67 1P GRANITE/CITY FACILITY APCI-MEMO-67 12/15/67 HALUCARBUN-6-25-WAX, HALUCARBUN PRODUCTS CURP d. HALOCARBUN-11-14E, HALOCARBON PRUDUCTS CORP HALUCARBUN-11-21E, HALOCARBON PRUDUCTS CORP APCI-IAIA-03 APCI-IAIA-06 APCI-IAIA-02 APC I - IA 1A - 04 GLASS-FIBEK-REINFORCED PLASTIC APCI-6 GLASS-WOOL APCI-IA3A-03 IP 2/21/72 GLASSES SAVE ANOTHER PAIR OF EYES HALOCARBON PRODUCTS CORP HALOCARBON PRODUCTS CORP HALOCARBON PRODUCTS CORP HALUCARBON PRODUCTS CURP HALCCARBON-WAX-6-25 HAZAKÜS. 990001890 YL-ETHVL-KETUNE, KERUSENE, 990002770 HOSE-CONNECTOR ACCIDENT-990002780 APCI NEAR-MISS ACCIDENT-990000400 SULATION AND MINERAL FIBER 990000090 FCAR INSULATION, AND HAVEG O ELECTRICAL INSULATIONS-990001890 TED-BIPHENYL-ARGCLUR-1254, NMETALLIC MATERIALS DESIGN 990001400 CRUSIZE, MONSANIO-PYDRAUL, JUDRY FOAM INSULATION, AND ULF-MECHANISM-HYDRUCARBON, SAFETY, MATERIAL, CLUTH-ASBESTUS, SLE CONTAMINANT CONTENT IN LON, MOLYBDENUM-DISULFIDE, 990004320 ANTS- HALOCARBON-6-25-WAX, LUBRICANTS-ITY AND EXPLOSION HAZARUS-APCI PIPING- INTRUDUCTION FARNBUROUGH FARNBURDUGH 990000730 FLAMMABILITY AND EXPLOSION 9900007c0 FLAMMABILITY AND EXPLESION SAFETY 9900C4730 PCI GASKETS AND PACKINGS--SILICUNE-PAINT-XP-7-1003, 990004310 ICANTS- HALCCARBUN-II-14E, - HALCCARBON-25-55-GREASE, 990004300 ICANTS- HALOCARBUN-11-21E, LUBRICANTS-LUBRICANTS-LUBRICANTS-QUIPMENT- WEARING APPAREL UXYGEN COMPRESSOR MANUAL FIRE APCI SYSTEM-EMERGENCIES APCI SYSTEM-EMERGENCIES 950000720 FLAMMABILITY AND EXPLOSION 990000710 FLAMMABILITY AND EXPLOSION 990000740 FLAMMABILITY AND EXPLUSION AND EXPLOSION PRUDUCT VAPOR 990001400 ANKS-SILICONÊ-DC-44, MORSE FARNBORDUGH XYGEN GENERATING PLANT AT APCI TESTING CYLINDERS HAS 115 SCHMUYER, W. W. APCI BALL, M.L. APCI APCI APL EVERSON, I. EVERSON, I. APL KEHAT, E. KEHAT, E. APCI APCI APCI APCL APCI MEDICINE MEDICINE MEDICINE 990000750 FLAMMABILITY NOI ICN CS 067000069 019400066 990001440 990061490 990002590 990004340 047400066 990004100 990001400 099000066 990005900 068500066 069100066 990001690 990001290 990001830 069000066 066100066 090100066 990002510 990004310 990004300 990004340 990004320 990004250 990004260 990003200 990002000 990003030 990004270 019000066 019000066 065000066 00000066 990001380

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990004720 S, AND ADHESTVES- NYLON-66
990001030 Y ASPECTS OF RECONSTRUCTED
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                                                        DS, AND EXPLOSION TESTING-
                                                                                        I DEVELOPMENT OF STANDARD
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                                                                                                                      XPLOSION TESTING- STANUARD
                                                                                                                                                                                                                                         K. AEKUJET-GENEKAL CORP
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                                                                                                                                                   DEVELOPMENT OF STANDARD
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KALDE,R.A. APCI KEL-F
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CRYOGENIC LIQUID
                             KEHAT, E.
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                             APCI
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HIGHWAY ACCIDENT APCI-SAFETY-GRAM-ND-17 IP 8/10/62
HI-PROOF STAINLESS STATIC-TANKS FOR OXYGEN SERVICE APL-QCP-Q13 REV.O IP
HISTORY, SAMPLING, AND ANALYSIS APCI PLANT MANAGERS SAFETY MEETING-CREIGHTON/
H.M.S.-EAGLE APL-X0425 SP PLUS APPENDIX A AND b 6/1d/71 PLUS MINUTES OF MEETI
HMS ARK-ROYAL 8/11/71 TO DISCUSS SAFETY OF SHIPBOARD LOX-PLANTS 2P 9/13/71 PL
HMS ARK-ROYAL ON 11/3/71 TO DISCUSS SAFETY OF SHIPBOARD LOX-PLANTS 2P 9/13/71
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HIGH-PRESSURE DXYGEN COMPATABILITY TESTS WITH SILICONE-RUBBER GASKET COMPOUND- RTV-
HIGHNAY ACCIDENT APCI-SAFETY-CONNECTOR APCI-MEMO-63 05/17/42 15
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   HYDROCARBON FILMS IN UXYGEN SYSTEMS APL-SAFETY-DEPT-INFO-SHEET-41 2P 4/8/71 HYDROCARBON FILMS IN SYSTEMS CONTAINING LIQUID AND GASEOUS CXYGEN USAF-CONTRAC HYDROCARBON FILMS IN SYSTEMS CONTAINING LIQUID AND GASEOUS CXYGEN ADVANCES IN HYDROCARBON FILMS IN OXYGEN SYSTEMS AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND A HYDROCARBON TYPE CUTTING-OILS, KNOWN AS TYPE-GROUP-II, PLANT WASH-CUT STUDIES, CELL HYDROCARBON-GREASE, HYDRAULIC-OIL, CHLORINATED-BIPHENYL-AROCLOR-1254, GRAPHITE-CHLO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    HYDRANT-HOUSE AND EQUIPMENT
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 HYDRAULIC-UIL, CHLORINATED-BIPHENYL-AROCLOR-1254, GRAPHITE-CHLOR-BIPHENYL, VINYL-CH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        HEXADECANE, HYDROCARBON TYPE CUTTING-UILS, KHOWN AS TYPE-GROUP-II, PLANT WASH-UUT S
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        HEAT-EXCHANGER CLEANING REQUIREMENTS APCI-QUAL-C HEAT-EXCHANGERS APL-ENGR-SPEC-E.02 9P 6/28/70
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                                                                                                                                                                                                                                                                                                                                                                                             HYLOMAR-UNIVERSAL-JUINTING COMPOUND SQ-32 AND VITON A
                                                                                                                                                                                                                                                                                                                                                                                                                          HYDROSTATIC TESTING-GENERAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                        HYDROCARBON-UIL, TITANIUM-TETRACHLORIDE APCI-MAR-87-0-8822
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               HOUDRY FUAM INSULATION, AND HAVEG GLASS-FIBER-REINFORCED PLASTIC APCI-MAR-87-0-88
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   HEAT PROTECTIVE CLOTHING
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                                                                                                                                                                                                                                                                 ICI LTD/UK APCI-1444-07 IP 2/21/72
ICI TONNAGE OXYGEN PLANT AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND ARMONIZ
IGO QUALITY ASSURANCE PROGRAM COST-PROCEDURES DIST-UPER-MAN-VOL-4-SECT-0.3
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                             IGNITION TEST-APPARATUS, FLORUBE-GREASES, EPOXY COMPOUNDS DEVCON-2-TUN AND DEVCON-F
IGNITION TESTS OF T-FIEM AND PENTON — APCI-MEMO-61 11/28/61 2P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    HUMAN TORCHES
                                                                                     IGNITION TEST METHYLENE-CHLORIDE- DICHLORGETHANE- TFICHLORGETHANE- TRICHLORETHYLENE
                                                                                                                   IGNITION TEST METHOD, APL PIPING-RESIDUE, METHYLENE-CHLURIDE
                                                                                                                                                                           IGNITION OF METALS IN DISPOSAL SYSTEMS &PCI-IID2-1 1P 8/22/71
                                                                                                                                                                                                                                         IGNITION CHARACTERISTICS OF METALS AND ALLOYS
IGNITION-LIMITS OF CARBON STEEL IN CXYGEN-NITROGEN-ATMOSPHERES
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 TESTING-
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                TESTING-
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                TESTING- PINE AND MAPLE WOUD, ACTIVATED CARBUN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 APCI-SAFETY-STD-627.4.7 29 5/68
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OMIC-REPORT-224 33P PLUS APPENDIX
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             [TY APC1-MEMO-67 12/15/67 1P
APL-ENGR-STD-LS.08 6P 10/21/69
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                                                                                                                                                                                                                                                                                                       SAFETY IN AIR AND AMMONIA
                                                                                                                                                                                                                                                                                                                                                                                               APC1-I+0-N0-81-0095
                                                                                                                      APCI-MAR-87-0-8321
                                                                                                                                                                                                                                                                                                                                                                                                                                17/1/71
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APCI-IWC-NO-LB-004
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INDUPOL-POLYBUIENE-OIL AMOCO-L-10, INDUPOL-POLYBUIENE-UIL AMOCO-H-100, PENTON, THE INDUPOL-POLYBUIENE-OIL AMOCO-L-10, INDUPOL-POLYBUIENE-UIL AMOCO-L-100, PENTON, T-FILM-THREAD COMPGUND APCI-MAR-87-0-INERT-CRYGGENS BELOW THE DEW-POINT OF AIR-SYSTEMS UNARCO APCI-MEMO-63 11/1/63 INHERT-CRYGGENS ABOVE THE DEW-POINT OF AIR-SYSTEMS UNARCO APCI-MEMO-63 11/1/63 INHIBITIOR CRYGGENIC ENGINEERING CONFERENCE PROCEEDINGS 1958 ADVANCES IN CF INLET CONNECTIONS ASA-657-1 57P 1965 INLET CONNECTIONS CGA-PAMPHLET-V-1 57P 1965 INLET CONNECTIONS CGA-PAMPHLET-V-1 57P 1965 INLET CONNECTIONS CSA-896 57P 1965 INLET CONNECTION REQUIREMENTS FOR CUSTOMER BULK GAS SUPPLY SYSTEM APCI-DIST-OPER-MAN-V IGNITIGN-TEMPERATURE IN 100-PERCENT GXYGEN ATM APCI-ANAL-REP-60-496 APCI-IWO-N INDGIL CHEMICAL INDGPOL-I-10-POLYBUTENE, INDGPOL-H-300-POLYBUTENE, MOBILE-DTE-105-H INDGPOL-H-300-POLYBUTENE, MOBILE-DTE-105-HYDROCARBON APCI-TM-040 7P 9/18/59 INDGPOL-I-10-POLYBUTENE, INDGPOL-H-300-POLYBUTENE, MOBILE-DTE-105-HYDROCARBON APC INSPECTION AND MAINTENANCE PLANS FEDERAL REGISTER VUL-35 NU-205 10/31/70
INSPECTION CONTRACT WITH MARYLAND CASUALTY CO APCI-POM-SEC-0.09-ATTCHMT-1 2P
INSPECTION FOR EQUIPMENT IN AIR PLANTS AND IN DXYGEN SERVICE APCI-POM-SEC-1.06 7
INSPECTION CODE- A MANUAL FOR BOILER AND PRESSURE VESSEL INSPECTORS 150P 1968 INSPECTION OF DECONTAMINATED COMPONENTS, AND PICKLING OF CARBON-STEEL PIPE AND FINSPECTION REQUIREMENTS FOR BULK LIQUID CUSTOMER INSTALLATIONS APCI-DIST-OPER-MA INSPECTION WHERE WHY AND HOW PREVENTIVE MAINTENANCE PRUGRAM APCI-IIIA5-2 5P INSPECTION WHERE WHY AND HOW INSULATION CHECK APCI-IIIA4-1 1P 9/12/71 INSPECTION WHERE WHY AND HOW LEAKS APCI-IIIA2-1 1P 9/12/71 INSPECTION, REGARDING APCI CLEANLINESS REQUIREMENTS APCI-MEMO-71 07/22/71 2P.

INSTALLATION AT CUSTOMER SITES APL-IGO-ENGR-MAN-40-01 7P 7/19/71
INSTALLATION OF A CRYGGENIC TANK APL-IGO-ENGR-MAN-60-01 6P 5/19/71
INSTALLATION OF BULK OXYGEN SYSTEMS AT CONSUMER SITES-1965 NFPA-NG-566 10P 1
INSTALLATION OF BULK OXYGEN SYSTEMS AT CONSUMER SITES-1965 MENDMENTS PART INSTRUMENTATION— ESTABLISHING PRESSURE—SETTINGS OF SAFETY DEVICES APCI-DES-ENG-ST INSTRUMENTATION— MODIFICATION TO EXISTING PRESSURE—GAUGES SNUBBER APCI-DES-ENG-ST INSTRUMENTATION— PRESSURE INDICATORS APCI-DES-ENG-STD-S31.2 5P 16/63 INSTRUMENTATION— SPECIAL REQUIREMENTS SAFETY AND RELIEF VALVES APCI-DES-ENG-STD-SINSTRUMENTS APCI-LIB-1 2P 11/1/71 INSULATION SYSTEM DUE TO VIBRATIONS DETERIORATION APCI-IIF3C-I 1P 12/30/71 INSULATION MATERIALS FOR CRYGGENIC SYSTEMS MILFOAM URETHANE INSULATION NATIONAL-GY APCI-BROCHURE APC1-DES-ENG-ST0-5 MATERIALS VASCOCEL MILFOAM NATIONAL-GYPSUM (GREEN) FOAM-GLAS (CORNING) NATIONAL-GYPSUM-BLUE LOX-SYSTEMS FOAM-GLASS LIQUIO-HYCROGEN-PIPING-SYSTE INSPECTION WHERE WHY AND HOW LEAKS APCI-IIIA2-1 IP 9/12/71
INSPECTION WHERE WHY AND HOW SYSTEM INSTRUMENTATION AND CONTROLS APCI-IIIA3-1
INSPECTION WHERE WHY AND HOW GENERAL CONSIDERATIONS OF THE AGING SYSTEM APCI-II APC I-DES-ENG-STD-581.1 SITES PROPOSED AMENDMENTS APCI-BROCHURE 4P 4/70 APCI-SAFETY-STD-608.1 7P 10/65 APCI-1144-2 APCI-IIA4-1 1P 12/30/71 5P 10/30/68 INSULATION AND PAINTING- COLD-INSULATION AND MINERAL FIBER GRANULATED INSULATED TANK-TRUCK SPECIFICATION CGA-341 FOR COLD LIGUEFIED-GASES INSULATION APCI-QUAL-CONT-LAYUUT-1031 2P 7/1/71 APCI-QUAL-CONT-LAYUUT-1031 2P 7/1/71 APCI-DES-INSULATION AND PAINTING- COLD-BOXES THERMAL TANKS PERLITE APCI-DES-INSULATION AND PAINTING- COLD-BOXES, THERMAL TANKS, GLASS WOOL APCI OUTFITS 1P 9/12/71 IGNITION-LIMITS OF SOME STAINLESS STEELS IN AN OXYGEN-ATHOSPHERE TANKS APCI-PUM-SEC-6.05 INSTRUCTION FUR REGULATORS AND COMPRESSED GASES APCI-BRC INSTRUCTIONS FOR AIR-PRODUCTS REDI-SET WELDING AND CUTTING INSTRUMENTATION APCI-IIF3-2 2P 2/4/72 INSULATION CHECK APCI-111A4-1 IP 9/12/71
INSULATION FIELD FABRICATED FLAT-BUTTUM LGX STURAGE APC I - I I I A 1 - 1 FABRICATED DX STORAGE TANKS INSPECTION- MATERIALS AND OXYGEN SERVICE INSPECTION WHERE WHY AND HOW STRUCTURE INSTRUMENTATION PREVENTIVE MAINTENANCE INSULATION SHOP INSULATION INSULATION 990001890 L, SODIUM-NITRITE-SOLUTION 990003180 CENT- IT ONLY PREVENTS AN 990002360 CYLINDER VALVE OUTLET AND 990002350 CYLINDER VALVE OUTLET AND 990002370 CYLINDER VALVE OUTLET AND EAT USED IN K-G REGULATOR-990000630 PGLYBUTENE-UIL AMGCO-L-IG. 9900C2920 PIPING-SYSTEMS LNG-SYSTEMS 99000292C DEW-PUINI OF AIR-SYSTEMS APCI MAINTENANCE AND CASUALTY CG APCI FIELD APCI CLEANING AND 990002120 NSPECTURS NATIONAL BOARD 990005810 PROGRAM- SYSTEM CHECK AND PRUGRAM- SYSTEM CHECK AND PRUGRAM- SYSTEM CHECK AND 990002210 SSIGN WITH MR E LUCAS-IPD 990004110 CHAMBERS,J. APL LOX 990001900 FIRE PROTECTION ASSUC 990001910 FIRE PRUTECTION ASSUC 990002880 APCI OPERATING AND SAFETY 99000Z890 APCI SET—UP AND OPERATING 990001020 PTION OF CLEANING-MEDIUMS, APCI MAINTENANCE AND PRUGRAM- SYSTEM CHECK AND PRUGRAM- SYSTEM CHECK AND PRUGRAM SYSTEM CHECK AND 990000240 990005820 ES FOR FILTERS, TRAPS, AND HELL-2-1176-A-HYDRUCARBUN, DRUCARSON, INDUIL CHEMICAL ILS DOM-CURNING-RF-1-0065, CLEANING AND 990064170 J. APL PRUCEDURE FOR THE GVERPRESSURE INTEGRITY OF MALFUNCTIONS AND FAILURES 990003520 SAFETY-STANDARDS FILING OF 9900C5750 SPECTION WHERE NHY AND HON 990302930 PCI FLAMMABILITY TESTS UN L INDOPOL-I-10-POLYBUTENE, 990005680 YOUN-TRANSFER-EQUIPMENT OR UF FIBERIZED MINERAL WOOL SYSTEMS MILFOAM URETHANE OVERPRESSURE INTEGRITY OF APCI APCI APCI APCI APCI APCI APCI 990002920 L, M.L. KITSUN, F.K. APCI F IRE F IRE 9900C1400 990005430 990001330 99000066 000110066 990001400 990001920 9900C2050 056000066 990001930 990005790 990005800 090000540 075000066 990005770 990005780 9900C57c0 990001310 076700066 088100066 00000066 990302290 990000230 990002820 990000220 990000240 050000055 990000410 005000066

INSULATION- PREFORMED CELLULAR GLASS SECTION FOR PIPELINES APL-ENGR-SPEC-N.05 5 INSULATIONS STYROFOAM AND POLYURETHANE-FOAM-INSULATION, RAYBESTOS-MANHATTAN-PACKING INSULATION, AND HAVEG GLASS-FIBER-REINFORCED PLASTIC APCI-MAR-87-0-8821 IP 6/62 IPD SPECIFIED PAINT SYSTEMS APCI-QUAL-CUNT-LAYOUT-120F 3P 7/1/71 IRON CONTINENTAL-STANDARD-GGG-38 APCI-1A6A-34 1P 2/21/72 IRON-GXIDES, TALC, ASBESTOS, ALUMINUM-CHIPS, STEEL-WUOL, MAGNESIUM-CHIPS, MAGNESIUM APC I-I APL-Q INTEGRITY OF INSULATION FIELD FABRICATED FLAT-BOTTOM LOX STORAGE TANKS INTEGRITY OF INSULATION SHOP FABRICATED OX STORAGE TANKS APCI-11A4-1 INTERNAL CLEANING OF ALUMINUM TANKEKS AND STATIC-TANKS FOR OXYGEN SERVICE INTERNAL CLEANING OF 9% NICKEL AND HI-PRODE STAINLESS STATIC-TANKS FOR OXYG APCI-ANAL-REP-71-336 IP 10/22/71 IMG-NG-XD-0134 88P 1971 ON AND DEVCON-F, FUAM-TYPE OSION TESTING- HOUDRY FUAM 990004020 RING QUALITY PROCEDURE FOR 990005200 MENTS- SHPEROIDAL-GRAPHITE APCI KEQUIREMENTS FOR APC I 990005430 UNAL-HAZARUS- UVERPRESSURE ONAL-HAZARDS- OVERPRESSURE RING QUALITY PROCEDURE FOR XANE, LS-53, BUTYL-RUBBER, 990002110 SURE VESSEL CODE SECTION 990003130 ITE THREAD COMPOUND 09000066 059000066 990005420 990004010 069100066 080000066

JOHN-DORE-CO, MELRAIH-GASKET-CU, VALLEY-GRGE-GASKET-CU LOX TRANSFER FLUGRUGREEN-E-JOHN/DORE CO APCI-IA5A-04 1P 2/21/71
JOHN/SUMMERS STEEL WORKS/SHOTTON PUMP-TYPE-GBI14-SERIAL-NO-79 APL-SAFETY-DEPT-R JOHNS-MANVILLE APCI-IA3A-02 1P 2/21/72
JOHNS-MANVILLE ASBESTGS SHEET PACKING STYLE-NO-61 GARLOCK-900 APCI-IWD-NO-L8-0 JOHNS-MANVILLE ASBESTGS SHEET PACKING STYLE-61 APCI-MEMO-71 06/2/71 1P PLUS JOHNS-MANVILLE ASBESTGS-61 SHEET APCI-ANAL-REP-71-344 AND APCI-ANAL-REP-71-3 JOHNS-MANVILLE-70 GASKET MATERIAL, CLOTH-ASBESTOS, GLASS-COTTON-ALUMINIZED-MIL-C-82 JOINTS IN HIGH-PRESSURE GASEOUS GXYGEN-LINE AT A CYLINDER FILLING DEPOT APL-SAFE APCI-108 JOB SPECIFICATION 310000 GALLON CAPACITY LOX/LIN STORAGE TANK 990003090 Y UF MATERIAL WITH UXYGEN 990003100 ERIALS GARLUCK-900 DURABLA 990003040 TON-A (BLACK) GARLUCK-900 990001890 G COMPANY-GASKET MATERIAL, 990003870 I. APL FAILURE OF BRAZED 990001460 TS IN DXYGEN ATMUSPHERES 990004760 CKINGS- FLUGROGREEN-E-600, N TANKER-400-11 1/7/70 AT AL INSULATIONS- TRANSITE, KRILL, M. R. 000400066 990003890

990004330

APCI LUBRICANTS- KEL-F-90-GREASE, MINNESDTA MINING MANUFACTURING CO APCI-IAIA-05 1P 2/21/72
990004330

990001400 RALUBE-FS, FLUDRQLUBE-FS, KEL-F-LF3, VERSILUBE-F-50, SFB1(40)-SILICONE, PYDRAUL-F-9, DGW-CORNING-4 COMPOUND S
990001400 RALUBE-FS, FLUDRQLUBE-FS, KEL-F-POLYMER, NYLON, CUTING-OILS APCI-MAR-87-0-8822 IP 5/63
990001390 LYTRICHIOUROVINYLCHLORIDE, KEL-F, POLYHEXAFLUGROPROPYLENE VITON A VINYLIDEND FLUDRIDE, POLYDIMETHYLSILOXANE, F
990001390 GHDL, METHYL-KETONE, KERUSENE, GLYCERINE, POLYETHYLENE-LGW-DENSITY, POLYETHYLENE-IRRADIATED, POLYVINYLCH
990000570 IST, J.M. APCI CONTROLLED KINETICS EXPERIMENTS- TEFLON-HUSES, SUPPURTED BY BRAIDED STAINLESS-STEEL-HOUSING,
99000440 I LUBRICANTS- VOLTALEF-3A KINGSLEY AND KEITH LID/UK APCI-IAIA-16 IP 2/21/72 APCI-IMC-NO-XD0123 APCI-ANAL-REP-60-4 DEMAG-LETT APCI-1 WO-NU-XD0123 APCI-1A5A-06 APCI-MEMO-63 05/17/63 1P APCI-IA5A-09 1P KA-27-IV/KA-4-IV OXYGEN COMPRESSOR VITON-A: (BLACK) VITON-E60 (GREEN) APCI NYLON-SEAT USED IN K-G REGULATOR- IGNITION-TEMPERATURE IN 100-PERCENT GXYGEN ATM APC1-123 GASKETS AND PACKINGS- KLINGERIT-601 RICHARD KLINGER LTD/UK GASKETS AND PACKINGS- KM226-SHEET ASBESTOS GASKET MATERIAL NICOLET INDUSTRIES INC GASKETS AND PACKINGS- KM240 SHEET-ASBESTOS GASKET MATERIAL NICOLET INDUSTRIES APP APC1-123 APCI-ANAL-REP-70-013,70-014,70-015 2/21/72 2/21/72 2/21/72 2/21/72 2/21/72 KEENE-BINDER APCI-144A-02 IP 2/21/72 KEL-F HIGH-PRESSURE OXYGEN COMPATIBILITY- NYLON APCI-ANAL-REP-70-013,70-014,70-015 APCI-IAIA-UL APC I-1A1A-09 APCI-IAIA-10 APCI-IALA-08 APCI-1A1A-15 KEL-F-81 APCI-IA4A-03 IP 2/21/72 LUBRICANTS- KRYTOX-143-AC-GIL GUPGNT LUBRICANTS- KRYTOX-143-AD-GIL DUPGNT KRYTOX-143-AA-OIL DUPONT LUBRICANTS- KRYTOX-143-A8-DIL DUPUNT KPYTGX-143-42-01L DUPONT KM-226, KM-246 UTION GARLUCK-900, KM-226, KM-246 GASKETS AND PACKINGS-GASKETS AND PACKINGS-990001420 ER-EXTRACTION GARLOCK-900, LUBR ICANTS-ELASTOMERS, AND ADHESIVES-ELASTOMERS, AND ADHESIVES-LUBRICANIS-NISSLER, K.H. DEMAG WALDE, R. A. APCI APCI APCI APCI APC I APC I 990004670 990004680 748400066 990004180 990004810 990001420 088700066 990003050 990001320 990004290 990004360 990004370

P 8/22/71 8/22/71 2P PLUS 3P ATTACHMENTS di APCI-1101-1 2P APC 1-1104-1 STANDARD-620. 2/70 TIME LIMITS DRAINAGE AND ULTIMATE DISPUSAL ARRANGEMENTS 03/22/71 01/28/59 API 990003430 DESIGN AND CONSTRUCTION OF LARGE, WELDED, LOW-PRESSURE STORAGE TANKS 990001110 POLYVINYLCHLÖRIDE, PLASTIC LEAD SEAL-NO-Z-JOHN CRANE APCI-MEMO-59
990005500 TIUNAL-HAZARDS- SPILLS AND LEAKAGE APCI-IID-1 2P 9/3/11
990005540 TIUNAL-HAZARDS- SPILLS AND LEAKAGE DETECTION- QUANTITY AND RESPONSE 990005510 TIUNAL-HAZARDS- SPILLS AND LEAKAGE DRAINAGE AND ULTIMATE DISPUSAL A APCI-MEMO-71 3/62 9 LATHROP AUTO-LUAD SYSTEM APCI-MAR-87-0-8821 990000670 IN IMPREGNATED FIBERGLASS LAVA MASTER, H. APCI 000005400

LIQUID DXYGEN METHYL-CHLORIDE, METHYLENE-CHLORIDE, CHLOROFORM, ETHYL-CHLORIDE, UICH LIQUID DXYGEN PUMP AICHE-CEP-TECH-MANUAL SAFETY IN AIP AND AMMONIA PLANTS V-LIQUID DXYGEN PUMP FAILURES RE-99000301 LIQUID DXYGEN PUMP FAILURES AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLIQUID DXYGEN PUMP FAILURES AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLIQUID PUMPS APCI-IIF1-4 IP 2/21/72 990002890 S ON CENTRIFUCAL PUMPS FOR LIQUID-OXYGEN CRYGGENICS V-10 PP241-248 BP 6/70
990002800 URING CHEMISTS ASSGC INC LIQUID-OXYGEN EXPLOSION MCA-CASE-HISTORY-NU-824 2P 8/62
990003800 URING CHEMISTS ASSGC INC LIQUID-OXYGEN PUMPS ALUMINUM IN GXYGEN SERVICE LIQUID-CARBONIC-LIQUID-OXYGEN TRAILE
990003800 RDALE FLOKIDA 5/11/71 LIQUID-OXYGEN PUMPS ALUMINUM IN GXYGEN SERVICE LIQUID-CARBONIC-LIQUID-OXYGEN TRAILE
990003010 Y INFORMATION RELATIVE TO LIQUID-VAPOR-CLUUDS APCI-PAPER 7P 1971
990003030 PENNSALT CORP CLEANING UF LIQUIEFIED-GAS PROCESSING EQUIPMENT PENNSALT-TECHNICAL-BULLETIN 6P 2/33/60
990002920 10-HYDRGGEN-PIPING-SYSTEMS INFRT-CRYGGENES BELUW THE DEW-POINT OF AIR-SYSTEMS INFRT-CRYGGENS ABO 990001110 EROL-L-536 RUST-PREVENTIVE LEHIGH CHEMICAL CO-CHESTERTOWN-MD., PERMACEL-RIBBON-DOPE PERMACEL-NEW/BRUNSWICK/N 990004260 EVERSON,I. APL LIMITING VALUES OF OIL-CONTAMINATION OF STAINLESS-STEEL SURFACES EXPOSED TO GASEC 990002470 APCI LOX AND LIN VAPOR DISPOSAL-TANK-500-GAL APCI-DRAWING-92483D REV-8 9730/68 TIONAL-HAZARDS- SPILLS AND LEAKAGE ENVIRONMENTAL. WARNINGS AND ESCAPE. SYSTEMS... APCI-IIO3-1. 1P. 8/22/71. TIONAL-HAZARDS- SPILLS AND LEAKAGE SEPARATION OF INCOMPATIBLE MATERIALS AND IGNITION SOURCES. IN DISPOSAL. SYST APCI LIQUID AND GASEDUS GXYGEN SAFETY REVIEW DATA- ACCIDENT/INCIDENT INVESTIGATION AND TION REQUIREMENTS FOR BULK LIQUID CUSIOMER INSTALLATIONS APCI-DIST-OPER-MAN-V-L-SEC-4.2.3 IP 5/69 SHEET LP ATTACHMENT SYMPOSIUM P12-23 12P 9 APL-SAFETY-BULL-025 IP REPRINTED 1/68
POOLS ADVANCES IN CHYDGENIC ENGINEERING V-13 P555-565 IIP
POOLS CGA AIR-SEPARATION PLANT SAFETY SYMPGSIUM P12-23 I
APCI-SAFETY-GRAM-NO-54C 6P 1/31/67 P6 REVISED 1/31/68 T CVERHÄUL PROCEDURES FOR LIQUID PUMPS APCI-IIFI-4 IP 2/21/72
FIELD-FABRICATED CRYGGENIC LIQUID STORAGE-TANK (FLAT-BOITOM) APCI-99820A 18P 9/15/71
ALUMINUM IN OXYGEN SERVICE LIQUID-CARBUNIC-LIQUID-DXYGEN TRAILER— ACCIDENT VICTORY-MEMORIAL-HGSPITAL 5/70
LUE LOX-SYSTEMS FOAM-GLASS LIQUID-HYDROGEN-PIPING-SYSTEMS INERT-CRYGGENES BELOW THE : DEW-POINT GRUUP MEMO-19 10P 8/30/68 COMPATIBLE GASKET MATERIALS GARLUCK-900 DURABLA JOHNS-MANVILLE ASBESTOS NATIONAL SAFETY CONGRESS APC I-11F1-2 L APC1-OKAWING-924830 REV-8 9/30, APL-1GD-ENGR-MAN-40-01 7P 7/19/71 03/11/64 1P PLUS 9900000530 F.K. APCI LIQUID DXYGEN LOADING APCI-SAFETY-GRAM-NU-06 IP 11/11/01
990001940 APCI LIQUID DXYGEN LOADING AND UNLUADING OPERATIONS APCI-SAFETY-STD-635.19 6P 2/68
990001940 APCI FLEET SAFETY- LOADING AND UNLUADING OPERATIONS APCI-SAFETY-STD-635.19 6P 2/68
99000155710 PORT. TRANSPORT TO SYSTEM LOADING AND UNLUADING PROCEDURES FOR LIQUID DXYGEN TRANSFER APC 990061950 IFICATION CGA-341 FCR COLD LIQUEFIED-GASES - CGA-PAMPHLET-341-TENTATIVE-STANDARDS 13P 1970 APCI-MENU-71 05/4/71 2P PLUS 3P ATTACHMENTS APCI PIPING 3F 1/64 9/61 CONTAMINANTS MISSILE-PROGRAM 10P 1/6/58 APCI-DES-ENG-STD-514.6.2 4P 5/26/61 APCI-SAFETY-STD-630.2.6 3P 1/64 API STANDARD-620 2/70 APCI-MAR-87-0-8320 1P APCI-MEMO-64 NASA-TMX-53533 54P 11/3/66 LOW-TEMPERATURE-FLUIDS AND HIGH-PRESSURE DXYGEN APCI-SAFETY-GRAM-NO-06 STURAGE TANKS APCI-1144-2 IP 12/30/71 LGADING FACILITY APCI-SAFETY-STU-630.2.6 APCI-SAFETY-STU-630.2.6 MTP-P+VE-M-63-14 94P 12/4/63 APCI-LES-ENG-ST0-570.6 2P 1/15/71 34P 5/26/64 990003466 APCI SAFETY RELIEF VALVES LOCATION AND PIPING-DESIGN CONSIDERATIONS LOX AND LIN VAPOR DISPOSAL-TANK-500-6AL LOX INSTALLATION AT CUSTOMER SITES A APC1-PUM-SEC-1:14 5P 10/30/68 APC1-11F38-1 1P 2/18/72 72P 8/64 STURAGE TANK-NU-6 SANTA/SUSANA NASA-TMX-53773 119 5/12/71 NASA-TMX-53052 NASA-TMX-985 LUM-PRESSURE STURAGE TANKS 990000010 ITION, STANDARD BOMB TEST, LED-PLATE-251, PIPE-DOPE APCI-111A2-1 990000030 KITSON,F.K. JAPCT LIQUID DXYGEN LOADING 990001890 TIBILITY OF MATERIALS WITH LIQUID DXYGEN METHYL. 990003000 ON OF ENERGY RELEASE IN A LIQUID DXYGEN FUMP 990001280 TIBILLITY OF MATERIALS WITH LIQUID DXYGEN MTP-990001240 TIBILITY OF MATERIALS WITH LIQUID GXYGEN NAS. 990001270 TIBILITY OF MATERIALS WITH LIQUID GXYGEN NAS. 990001080 LBERGER,F. APCI NOTES ON LIQUID GXYGEN CONTA. 990001250 TIBILITY OF MATERIALS WITH LIQUID GXYGEN III FACILITY S- VAPORIZER AND CRYOGENIC LIQUID DISPUSAL CXYGEN OXYGEN OXYGEN MASTER, H. H. APCI AUTG LOAD SYSTEMS (THERMAL AND PRESSURE), LINE-SURGES OXYGEN CLEANING LOX STURAGE LOCA TION ENT- DELUGE-SYSTEM AND LOX LOADING APL EXPERIMENTS WITH LIQUID ON IN THE ATMOSPHERE FROM LIQUID LIGUED ATMOSPHERE FROM LIQUID SPECIION WHERE WHY AND HOW LEAKS APCI COLD-BOX LEAKS נייא נפא SCHNOYER, W. W. APCI PIPING- DXYGEN COMPRESSOR TRUCTION OF LAKGE, WELDED, HANDLING OF 990005430 D FABRICATED FLAT-BOTICM 990000550 UIPMENT- DELUGE-SYSTEM AND 990003410 FIELD-FABRICATED CRYGENIC RENDCS, J.J. AIRCO RENDOS, J.J. AIRCO CHAMBERS, J. APL RUBINSUN, G. W. APCI 990000900 ATLEY, A.L. APCI ON IN THE 990005520 990005590 990003430 086100066 066500066 000000066 990003070 990002920 045000066 057000066 990000150 990005730 061400066 06 57 00066 990002270 0%6900066 990002630 010600066 990002476 990003100

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990003140 PTURE DISCS MANUFACTURED LOX TANKERS BY AMETEK APCI-MEMO-71 06/22/71 1P
990000910
                  MASTER, H. H. APCI LOX TANKS APCI-MEMO-70 06/26/70 1P
9900C1460 CG, VALLEY-FORGE-GASKET-CG LOX TRANSFER FLUOROGREEN-5-600 APC1-MEMG-70 10/23/70 1P
990002660
                  MASTER, H. H. APCI LOX TRANSFER PUMP SCREENS APCI-MEMO-69 01/24/69 2P PLUS 3P ATTACHMENTS
990002650
                  MASTER, H. H. APCI LOX TRANSFER PUMPS APCI-MEMO-68 12/30/68 2P PLUS 2P ATTACHMENTS
990003020 ISCUSS SAFETY OF SHIPBOARD LOX-PLANTS 2P 9/13/71
          INVESTIGATION OF CRYOSTAR LOX-PUMP EXPLOSION AT STOKE PLANT 8/7/70 APL-SAFETY-DEPT-REP-34 L4P 8/24/70
              BERRETTINI. 5. J. APCI LOX-PUMP FIRES AND EXPLOSIONS APCI-MEMO-70 06/26/70 3P
990003926 DUE TO THE CRYUSTAR-GBI14 LOX-PUMP ON AN SSPC LOX-TANKER PAPEL-SAFETY-DEPT-REP-32 9P 7/10/70
990003890 PL REPORT ON EXPLOSION OF LOX-PUMP ON TANKER-400-11 1/7/70 AT JOHN/SUMMERS STEEL WORKS/SHOTTON PUMP-TYPE-C
990002680
                STUMPLER, R.O. APCI LOX-PUMP SAFETY APCI-MEMG-71 2/19/71 1P
990002670 AUL, CARTER, AND COSMODYNE LGX-PUMP SAFETY APCI-MEMO-71 1/01/26/71 2P
990003270
                STOMPLER, R.D. APCI LOX-PUMP SAFETY-BARRIERS APCI-MEMO-71 02/19/71 2P
990003880 IN BURCKHAROT CENTRIFUGAL LOX-PUMP-TYPE-G8114-NO-29224 APL-SAFETY-DEPT-REP-16 6P 2/28/69
990002200
                    BALL, W.L. APCI LCX-SPILL NCG CONSHUHOCKEN: APCI-MEMO-68 05/23/68 2P
990002920 ATION NATIONAL-GYPSUM-BLUE LUX-SYSTEMS FOAM-GLASS LIQUID-HYDROGEN-PIPING-SYSTEMS ING-SYSTEMS INERT-CRYOGENES 8
990000920 LYSIS OF SUN-DIL COMPANY_S LOX-TANK VAPORIZER APCI-MEMO-64 04/9/64 IP PLUS IP ATTACHMENT
990003420 N 310000 GALLON CAPACITY LOX/LIN STORAGE TANK APCI-JOB SPECIFICATION FOR JOB-NO-00-2-2775 APCI-NO-71-
990001890 ANE, FLUGRINATED-SILUXANE, LS-53, BUTYL-RUBBER, IRON-OXIDES, TALC, 45BESTOS, ALUMINUM-CHIPS, STEEL-HOOL, MAGNE
                APCI PIPING-SSLI-5- LUBE-DIL-SERVICE -20F TO 150F 150-PSIC-MAX STAINLESS STEEL-PIPE APCI-DES-ENG-S
990001820
990001110 DUS MATERIALS- ABMA THREAD LUBRICANT AND SEALANT, ANDEROL-L-536 RUST-PREVENTIVE LEHIGH CHEMICAL CO-CHESTERTOW
              APCI TAPE-SEAL THREAD LUBRICANT AND SEALER- TAPE-SEAL FROM FRIESLAND-PLASTIC COMPANY, PERMACEL-TAPE AP
990001160
990000090
                SCHMOYER, W. W. APCI LUBRICANTS AND THREAD COMPOUNDS FOR DXYGEN-SYSTEMS APCI-SAFETY-GRAM-NO-27 5P 3/
990004450
                               APCI LUBRICANTS- ESSO BEACUN-325 APCI-IAIA-17 1P 2/21/72
990004420
                               APCI LUBRICANTS- FLUGRO-GLIDE, CHEMPLAST INC APCI-IAIA-14 IP 2/21/72
990004590
                               APCI LUBRICANTS- FLUOROLUBE, FS-5, HOUKER CHEMICAL APCI-IAIA-11 1P 2/21/72
990004350
                               APCI LUBRICANTS- FLUOROLUBE, FS, HOUKER CHEMICAL APCI-IALA-07 IP 2/21/72
990004460
                               APCI LUBRICANTS- FORMBLIN-Y04 MONTECATINI-EDISON APCI-IA1A-18 IP 2/21/72
                               APCI LUBRICANTS- HALOCARBON-11-21E, HALOCARBON PRODUCTS CORP APCI-IA1A-02 1P 2/21/72
990004300
990004310
                               APCI LUBRICANTS- HALOCARBON-11-14E, HALOCARBON PRODUCTS CORP: APCI-1A1A-03 1P 2/21/72
990004340
                               APCI LUBRICANTS- HALOCARBON-25-5S-GREASE, HALOCARBON PRODUCTS CORP APCI-IALA-06 1P 2
990004320
                               APCI LUBRICANTS- HALOCARBON-6-25-WAX, HALUCARBON PRODUCTS CORP APCI-1A1A-04 IP 2/21/
990004330
                               APCI LUBRICANTS- KEL-F-90-GREASE, MINNESCHA MINING MANUFACTURING CO APCI-1414-05
990004290
                               APCI LUBRICANTS- KRYTOX-143-AA-OIL DUPONT APCI-IA1A-OI IP 2/21/72
                              APCI LUBRICANTS- KRYTOX-143-AB-01L DUPONT APCI-IALA-08 1P 2/21/72
APCI LUBRICANTS- KRYTOX-143-AC-01L DUPONT APCI-IALA-09 LP 2/21/72
990004360
990004370
                              APCI LUBRICANTS- KRYTOX-143-AD-OIL DUPONT APCI-1AIA-15 1P 2/21/72
APCI LUBRICANTS- KRYTOX-143-AZ-OIL DUPONT APCI-1AIA-10 1P 2/21/72
990004430
990004380
990004410
                               APCI LUBRICANTS- MOLY-LUBE-NO-99, MOLY LUBE PRODUCTS GLEN/COVE/NY APCI-IAIA-13 1F
990004400
                               APCI LUBRICANTS- MOLYLUBE-N BEL-RAY CU FARMINGOALE/NJ APCI-IAIA-12 1P 2/21/72
                              APCI LUBRICANTS- VOLTALEF-3A KINGSLEY AND KEITH LTD/UK APCI-1414-16 1P 2/21/72
990000680 LYCEL-440R, AND STYROFOAM, LUBRICANTS, MOLY-SPRAY-KOTE, AND DRI-LUBE APCI-MAR-87-0-8821 1P 4/62
990000590 PLUSION TESTING- UCGN-TYPE LUBRICANTS, STEEL-PIPES APCI-MAR-87-0-8820 1P 4/61
990000700 ESTING- TALCUM-POWDER AS A LUBRICANT, TARSET, PLASITE APC1-MAR-87-0-8821 1P 7/62
990002210 PCI DISCUSSION WITH MR & LUCAS-IPO INSPECTION, REGARDING APCI CLEANLINESS REQUIREMENTS: APCI-MEMO-71 07/22
990000270
                              APCI MACHINERY- FIELD TESTING AND CENTRIFUGAL OXYGEN COMPRESSERS APCI-DES-ENG-STD-551.
990000260
                              APCI MACHINERY- FIELD TESTING AND RECIPROCATING UXYGEN COMPRESSORS APCI-DES-ENG-STD-55
990001890 LUMINUM-CHIPS, STEEL-WOOL, MAGNESIUM-CHIPS, MAGNESIUM-SHEET, DYE-PENETRANTS, MAGNOGLO-PASTEIO IN KEROSENE, TU
990001890 EEL-WOOL, MAGNESIUM-CHIPS, MAGNESIUM-SHEET, DYE-PENETRANTS, MAGNJGLU-PASTEIO IN KEROSENE, TURCO-DYE-CHECK-STE
990001890 IUM-SHEET, DYE-PENETRANTS, MAGNOGLO-PASTEIO IN KEROSENE, TURCO-DYE-CHECK-STEP-2-LIQUID, TURCO-4499-I, TUCRO-4
990005670 L-HAZARDS- OXYGEN-TRANSFER MALFUNCTION: AND FAILURES APCI-11F3-1 1P 11/12/71
990005680 L-HAZARDS- GXYGEN-TRANSFER MALFUNCTION AND FAILURES APCI INCIDENTS INVOLVING DXYGEN-TRANSFER-EQUIPMENT OR INST
990005690 L-HAZARDS- OXYGEN-TRANSFER MALFUNCTIONS AND FAILURE INCIDENTS WHICH OCCURRED WITH OTHER OXYGEN-EQUIPMENT APC
990005730 L-HAZARDS- CXYGEN-TRANSFER MALFUNCTIONS AND FAILURES GEISEFING, EXCESSIVE VIBEATIONS, SHOCK (THERMAL AND PRE
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990005746 L-HAZARDS- CXYGEN-TRANSFER MALFUNCTIONS AND FAILURES INSULATION SYSTEM DUE TO VIBRATIONS DETERIORATION APC
990005720 L-HAZARDS- OXYGEN-TRANSFER MALFUNCTIONS AND FAILURES VALVES APCI-IIF3A(3)-1 1P 12/30/71
990003830 ENT AT AN OXYGEN CHARGING MANIFOLD APL-SAFETY-BULL-046 2P
990003840 RISING FROM VENTING-DXYGEN MANIFOLDS CONNECTED TO A COMMON VENT PIPE APL-SAFETY-BULL-075 3P 12/11/69
990003760 CHARGING AND DISCHARGING MANIFOLDS CXYGEN SERVICE APL-ENGR-SPEC-L.12.1 2P 7/7/69
990000620 XPLOSION TESTING- PINE AND MAPLE WOOD, ACTIVATED CARBON APCI-MAR-87-0-8821 IP 10/61
990002050 D INSPECTION CONTRACT WITH MARYLAND CASUALTY CO APCI-POM-SEC-6.09-ATTCHMT-1 2P 8/27/69
990001890 0070, WALK-SYNTHETIC-CORK, MASKING-TAPE, SHERLOCK-LEAK-DETECTOR-TYPE-OG, SHERLOCK-LEAK DETECTOR-WITH-15-PERCEN
                 SCHNYDER, R. APCI MASTER DRAWING 1200-SERIES REGULATIONS APCI-DRAWING-000-0-407004E 1P 3/4/68
990003080
990003570 NFIRMATION OF REVISION OF MAXIMUM ALLOWABLE OPERATING PRESSURE FEDERAL REGISTER VOL-36 NO-176 9/10/71
990002220 ERSATIUN WITH MR. WILLIAM MCCORMICK REGARDING REQUIREMENTS FOR VENDOR-CLASS-AA AND CLASS-AAA CLEANING. APCT
990001890 ADHESIVE, PHENOLIC-MOLDED, MELAMINE-MOLDED, POLYESTER-GLASS, NYLON, MOLYBDENUM-DISULFIDE, GRAPHITE, ELECTROFIL
990001410 D SOXHLET ETHER-EXTRACTION MELRATH GARLOCK-900 APCI-4NAL-REP-70-026 APCI-1w0-N0-EA-7027 2P 1/30/70
990064740 ND PACKINGS- TFE-GF-GREEN, MELRATH GASKETS CO APCI-IA5A-02 1P 2/21/72
990001410 MATERIAL COMPATIBILITY OF MELRATH MATERIAL WITH OXYGEN CUMBUSTION IN UXYGEN AND SOXHLET ETHER-EXTRACTION MEL
990004770 PCI GASKETS AND PACKINGS- MELRATH-150 (SHEET-ASBESTOS GASKET MATERIAL) APCI-1A5A-05 1P 2/21/72
990001460 ATMOSPHERES JOHN-DORE-CO, MELRATH-GASKET-CU, VALLEY-FORGE-GASKET-CU LOX TRANSFER FLUOROGREEN-E-60C APCI-MEM
990005980 N PRESSURE VESSEL CODE-AD MERKBLATTER (ENGLISH TRANSLATION) 304P 9/71
990001540 GNITION CHARACTERISTICS OF METALS AND ALLOYS ARS JOURNAL P917-23 7P 7/61
990001530 AL INSTITUTE IGNITION OF METALS IN CXYGEN DMIC-REPORT-224 33P PLUS APPENDIX
9900C5950 DALY, J. APCI BURNING OF METALS IN OXYGEN ATMOSPHERES (80 TO 100-PERCENT) APCI-TM-186 44P 3/72
          INSTITUTE REACTIVITY OF METALS WITH LIQUID AND GASEOUS DXYGEN AD297124 DMIC-MEMO-163
990001520
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- MUNTZ-METAL 60-40-TYPE COMPOSITI
990005230
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALPHA BRASS-TYPE TCL-100 OR DTD-50
990005240
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- RED-BRASS-PIPE ASTM-843 APCI-1A6
990004920
990004900
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- COPPER-PIPE ASTM-842 APCI-1A6A-0
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALUMINUM ASTM-8211-2024-14 APCI-
990004930
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- TARSET PITTSBURGH CHEMICAL CO
990004870
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- SEALFAS-MASTIC-31-97 BENJAMIN FOS
990004880
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- COPPER-TUBE ASTM-B75 APCI-IA6A-O
990004910
990004890
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- PLASITE-NG-7122H WISCONSIN PROTEC
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALUMINUM ASTM-8209-5083-0 APCI-1
990004950
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- CARBON STEEL- NON-OXYGEN SERVICE W
990005190
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL-TYPE-304 UNIDENTIF
990005080
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- BERYLLIUM COPPER APCI-IA6A-25 2
990005110
990005070
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-4182-F-304 AN
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALUMINUM B361-WP6061-T6 APCI-1A6
990004990
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A240-304 AP
990005020
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- COPPER-SILICON ASTM-898GR8 APCI-
990005090
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A269-304 AP
990005120
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALUMINUM ASTM-8247-6061-T6 APCI-
990004980
990005200
                              APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- SHPEROIDAL-GRAPHITE IRON CONTINENT
990005050
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A194-8T321
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A403-WP304 AN
990005050
990005000
                             APCI: MÉTALS. ALLOYS. SOLDERS. AND SURFACE TREATMENTS- CARBON STEEL (OXYGEN SERVICE) . A
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- FREE-MACHING BRASS APCI-1A6A-24
990005100
990005150
                             APCI METALS, ALLUYS, SOLDERS, AND SURFACE TREATMENTS- MONEL ASTM-8164 APCI-1A6A-29 2P
990005010
                             'APCI METALS, ALLOYS, SCLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A312-TP304
                             APCI METALS, ALLOYS, SOLOERS, AND SURFACE TREATMENTS- BRONZE ASTM-B61 OR | B62 | APCI-1A6
9900C5130
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- SILVER APCI-IA6A-35 1P 2/21/72
990005210
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALUMINUM ASTM-8210-6061-T6 APCI-
990004960
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEELS-TYPE-416-CADMIUM-
990005060
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A320-88304
990005040
                             APCI METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALUMINUM ASTM-8241-6061-T6 APCI-
990004970
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NASA CXYGEN STUDY PROJECT 00-1-2495.07
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990605400 SCHMOYER, W. W. APCI

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METHYL-ETHYL-KETONE, KEROSENE, GLYCERINE, POLYETHYLENE-LOW-DENSITY, POLYFTHYLENE-IR
METLAS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- ALUMINUM, ASTM-B-210-3003 APCI-IA6A-
MILFOAM CORP APCI-IA3A-06 IP 2/21/72
MILFOAM MILFOAM CORP APCI-IA3A-06 IP 2/21/72
MILFOAM MILFOAM CORP APCI-IA3A-06 IP 2/21/72
MILFOAM NATIONAL-GYPSUM (GREEN) FOAM-GLAS (CORNING) APCI-IND-ND-LA-0333 APCI-
MILFOAM URETHANE INSULATION NATIONAL-GYPSUM-BLUE LOX-SYSTEMS FOAM-GLASS LIQUID-HYDR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            MINIMUM FEDERAL SAFETY-STANDARDS FOR GAS PIPELINES CUFRUSION-PITTIING- NOTICE OF PUBMINIMUM FEDERAL SAFETY-STANDARDS FILING OF INSPECTION AND MAINTENANCE PLANS FEDERAL NINIMUM FEDERAL SAFETY-STANDARDS REQUIREMENTS FOR CORROSION CONTROL FEDERAL RECOMINIMUM FEDERAL SAFETY-STANDARDS MISC AMENDMENTS FEDERAL REGISTER V-35 N-223 MINIMUM FEDERAL SAFETY-STANDARDS ESTABLISHMENT OF MINIMUM STANDARDS FEDERAL RE
                                                                                                                                                                                                                                     METHYLENE-CHLORIDE- DICHLORDETHANE- TRICHLOROETHANE- TRICHLORETHYLENE- CARBON-TEIKA
                                                                                                                                                                                                                                                                                                     METHYL-CHLGRIDE, METHYLENE-CHLGRIDE, CHLDROFDRM, ETHYL-CHLGRIDE, DICHLJRUETHANE, SI
                                                                                                                                                                                                                                                                      METHYLENE-CHLORIDE, CHLORUFORM, ETHYL-CHLORIDE, DICHLOROETHANE, DICHLORDETHANE, TRI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          REVISION 0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        MISTY PROBLEM VAPUR-CLOUDS FROM DEFROST OPERATIONS ALLEGEDLY CAUSED HIGHWAY ACCIDE
MOBILE-OTE-105-HYDROCARBON APCI-TM-040 7P 9/18/59
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        MOLLY-99 COMPATIBILITY TESTS WITH HIGH-PRESSURE DXYGEN DELATE THREED CONTINUED TO THE MOLY LUBE PRODUCTS GLEN/COVE/NY APCI-1AIA-13 IP 2/21/72
MOLY LUBE PRODUCTS GLEN/COVE/NY APCI-1AIA-13 IP 2/21/72
MOLY-LUBE-NO-99 APCI-MEMU-63 06/11/63 IP
MOLY-LUBE-NO-99, MOLY LUBE PRODUCTS GLEN/COVE/NY APCI-1AIA-13 IP 2/21/72
MOLY-SPRAY-KOTE, AND DRI-LUBE APCI-MAR-87-0-8821 IP 4/63
MOLY-KOTE-TYPE-Z AND TYPE-X-15 APCI-MAR-87-0-8822 IP 3/63
MOLY-KOTE-TYPE-Z AND X-15, CABOSIL-M-5 FORMICA-LAMINATE BONDED WITH A PHENOLIC RE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   MORSE GREASE, ALPHA-CORP-MOLYKOTE-MICROSIZE, MONSANTO-PYORAUL, GOLF-MECHANISM-HYORO MONIZ-METAL: 60-40-TYPE COMPOSITION CU-58 I-PERCENT 2N38,5-42-PERCENT PRO,35-39-
METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A351-GR-CFB METALS, ALLOYS, SOLDERS, AND SURFACE TREATMENTS- STAINLESS 9-PERCENT NICKEL STEEL METALS, ALLOYS, SGLDERS, AND SURFACE TREATMENTS- NOVUNOX STAINLESS STEEL ALLOY TO METALS, ALLOYS, SGLDERS, AND SURFACE TREATMENTS- BRASS-SHEET OR PLATE ASTM-B35 A
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                MGNEL ASIM-blo4 — APCI~1A6A-29 2P 2/21/72
MGNSANIG-PYDRAUL, GULF-MECHANISM-HYDROGARBOW, HAVOLINE-HO-HYDROCARBON, SHELL-2-1176
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              I-PERCENT 2N38,5-42-PERCFNT P80,35-,9-
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     MOLYLUBE-99, MGLYKUTE-TYPES-Z AND X-15, CABOSIL-M-5 FORMICA-LAMINATE BUNDED WITH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 MOBIL-DIE-105 TEXACO-CAPPELLA-44 CELLULUBE-550 FLUURGLUBE SEARS-THREAD-CUTTING-GIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      FEDERAL REGISTER VOL-35
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                APCI-R*D-NUTEBUDK-130 P16-7 2P 2/11/63
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              MINERAL WOCL INSULATION APCI-QUAL-CONT-LAYUUT-103L 2P 7/1/71
MINERAL-WOCL APCI-IA3A-04 1P 2/21/72
MINIMUM FEDERAL SAFETY-STANDARDS UDGRIZATION OF GAS FEDERAL REGISTER
MINIMUM FEDERAL SAFETY-STANDARDS EXTENSION OF TIME FOR CUNFIRMATION OR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         1P 2/21/72
1P 2/21/72
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MOLYLUBE-N APCI-MEMU-63 10/4/63 1P
MOLYLUBE-N APCI-R+D-NOTEBOOK-130 P16-7 2P 2/11/63
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MOLYLUBE-N BEL-RAY CO FARMINGDALE/NJ APCI-IAIA-12
                                                                                                                                                                               1/62
2P
                                                                                                                                 APCI-1A7A-06 1P 2/21/72
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            APL-ENGR-SPEC-N.02 3P 1/2/70
                                                                                                                                                                                                       APC I-MEMO-61 12/11/61
                                                                                                                                                                            APCI-MAR-87-0-8821 1P
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        60-40-TYPE COMPOSITION
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     MINERAL FIBER GRANULATED
                                                                                                                                                                         METHY LENE-CHLORIDE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  MUNIECATINI-EDISON
                                                                                                                                       METHYLENE-CHLORIDE
                                                                                                                                                                                                          METHYLENE-CHLORIDE
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                                                                                                                                                                                                                                                                                                                                                                                                                                                990064640 ICAL INSULATIONS- MILFDAM MILFDAM
                                                                                                                                                                                                                                                                                                  990001890 TERIALS WITH LIQUID DXYGEN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                           990004640 D ELECTRICAL INSULATIONS-
990062950 ULATION MATERIALS VASCOCEL
990002920 ALS FOR CRYGGENIC SYSTEMS
990000400 NTING- COLD-INSULATION AND
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        D ELECTRICAL INSULATIONS-
ND OTHER GAS BY PIPELINE-
ND OTHER GAS BY PIPELINE-
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NU GIHER GAS BY PIPELINE-
ND GIHER GAS BY PIPELINE-
ND GTHER GAS BY PIPELINE-
                                                                                                                                                                                                                                                                990001850 ID DXYGEN METHYL-CHLURIDE,
                                                                                                                                                                                                                                                                                                                                990001890 ROETHYLENE, ETHYL-ALCOHOL,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         990005800
PFGRAM,J.M. APL
990001310 H ACCEPIANCE OF FIBERIZED
                                                                                                                                       MISC-
                                                                                                                                                                   990000650 ETHOD, APL PIPING-RESIDUE, 990001070 TION FILTER DEFROST AND OF
                                                                                                                                                                                                                                     OF STANDARD IGNITION TEST
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    OF VARIOUS TYPES OF OILS-
BROPHY, M. APCI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         996001170 YGEN COMPATIBILITY TEST ON 990004410 APCI LUBRICANIS—990000680 AND STYROFUAM, LUBRICANIS,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    GAS BY PIPELINE-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  990004330 BRICANTS- KEL-F-90-GREASE,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   990001080 LIQUID GXYGEN CONTAMINANTS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         INDUPUL-H-300-POLYBUTENE,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          990004410 BRICANTS- MOLY-LUBE-NO-99;
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990005150 S, AND SURFACE TREATMENTS-
                                                               APCI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              D. POLYESTER-GLASS, NYLON,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   990000710 UGE TWF WOOL, SPINTEX-305,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     990000730 OSIGN HAZAROS- HALUCARBON,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       990064510 S AND THREADING COMPOUNDS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    990000730 - HALOCARBON, MOLYLUBE-99,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    990001200 YGEN COMPATABLLITY TESTS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      990081268 ESTS- MULYLUBE-KCTE-AR AND
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                OLYETHYLENE-TEREPHTHALATE,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              990001400 A-CORP-MOLYKOTE-MICROSIZE,
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                                                                                                                                    CALS, SOLVENTS, AND
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990003560 ND GTHER
990003540 ND GTHER
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APCI-MEMO-71 12/10/71 1P

NEAR-MISS ACCIDENT— BURNS/HARBOR APCI-MEMU-71 02/8/71 2P
NEAR-MISS ACCIDENT— CREIGHTON APCI-MEMU-71 02/8/71 2P
NEAR-MISS ACCIDENT— CREIGHTON APCI-MEMU-68 06/4/68 2P
NEOREME APCI-IA4A-05 1P 2/21/72
NEOREME APCI-IA4A-05 1P 2/21/72
NEOREME, EPOXY-ADHESIVE, PHENOLIC-MULDED, MELAMINE-MULDEU, POLYESTER-GLASS, NYLON, NICKEL SNE HI-PROOF STAINLESS STAINC-TANKS FUR CXYGEN SERVICE APL-QCP-Q13 REV.O
NICKEL SIEL ASTM-A353GB APCI-IA5A-09 1P 2/21/72
NICCLET INDUSTRIES INC APCI-IA5A-06 1P 2/21/72 NON-DXYGEN SERVICE WITH POSSIBLE EXPOSURE TO CXYGEN APCI-IAGA-33 3P 2/21/72 NGNMETALLIC MATERIALS DESIGN GUIDELINES AND TEST DATA-HANDBUOK MSC-02681 380P 5 NOTCH-SENSITIVITY OF MATERIALS APCI-IB2C-1 1P 9/2/71 NOTES FUR GUIDANCE OF CUSTOMERS HAVING AIR PRODUCTS LTD CXYGEN EQUIPMENT AP NOTES ON VISIT TO HMS ARK-ROYAL ON 11/8/71 TO DISCUSS SAFETY OF SHIPBGARD LOX-PL NOTES ON LIQUID CXYGEN CONTAMINANTS MISSILE-PROGRAM 10P 1/6/58 NATIONAL-GYPSUM-BLUE LOX-SYSTEMS FOAM-GLASS LIQUID-HYDROGEN-PIPING-SYSTEMS LNG-SYST NATIONAL-GYPSUM-BLUE NATIONAL-GYPSUM CORP APCI-1A3A-07 IP 2/21/72 NATIONAL BOARD INSPECTION CODE— A MANUAL FOR BOILER AND PRESSURE VESSEL INSPEC NYLON, MOLYBDENUM-DISULFIDE, GRAPHITE, ELECTROFILM-SPRAYABLE-A, DRILUBE-1, TEFLON NYLON-66 ICI LTD/UK APCI-1A4A-07 IP 2/21/72 NYLON-5EAT USED IN K-G REGULATOR- IGNITION-TEMPERATURE IN 100-PERCENT OXYGEN ATM NYLON, CUTTING-01LS APCI-MAR-87-0-8822 IP 5/63 NOTICE OF FUBLIC HEARING FEDERAL REGISTER VOL-36 NO-126 6/30/71 NOTICE OF FUBLIC HEARING FEDERAL REGISTER VOL-36 NO-126 6/30/71 NOTION XTAINLESS STEEL ALLOY TO DIN GEPMAN NATIONAL STANDARUS COMPOSITION NYLON APCI-1a4A-04 IP 2/21/72 NYLON APCI-MEMO-63 05/17/63 IP NYLON-66 ICI LTD/UK APCI-1a4A-07 IP 2/21/72 APCI-145A-12 APCI-IW0-NO-LA-0333 NATURAL-UNTREATED-FINISH TURNERS ASBESTUS CEMENT CU LTD/UK CO APCI-1A2A-04 1P 2/21/72 APCI-1A3A-07 1P 2/21/72 NATIUNAL-GYPSUM (GREEN) FOAM-6LAS (CORNING) APCI-MEMO-71 01/19/71 NCG CCNSHCHOCKEN APCI-MEMO-68 05/23/68 NATIONAL GREENHGUSE CO NATIONAL-GYPSUM CORP APO NASH VACUUM PUMPS PROTECTIV NOISE 990002920 ILFOAM URETHANE INSULATION 990004650 D ELECTRICAL INSULATIONS-990064700 ELASTOMERS, AND ADHESIVES-990001390 OLYSULFIDE-SEALER, BUNA-N, 990004020 R INTERNAL CLEANING OF 9% 990005170 ENTS- STAINLESS 9-PERCENT 990004810 -ASBESTOS GASKET MATERIAL 990004780 ASBESTOS GASKET MATERIAL 990005580 AL-MATERIALS-COMPATIBILITY 3F 9/13/71 PLUS E-MOLUED, POLYESTER-GLASS, JING COMPOUNDS- PUTTI-ROPE 990002930 MATERIALS VASCOCEL MILFOAM 990004846 ESTOS AND CEMENT BUARUS. 990002200 BALL, W.L. APCI LCX-SPILL TREATMENTS- CARBON STEEL-990004690 ELASTOMERS, AND ADHESIVES-990001320 SURE CXYGEN COMPATIBILITY-990004720 ELASTOMERS, AND ADHESIVES-990000720 UN HAZARDS- KEL-F-PULYMER, 990064650 LONS- NATIONAL-6YPSUM-BLUE 990003230 VE-EQUIPMENT- OCCUPATIONAL 990003550 PELINES CORROSION-PITTING-S, AND SURFACE TREATMENTS-990003250 TRIAL-SAFETY- OCCUPATIONAL APLI HUBBS, M.K. APCI NA SA-HOUSTON HIMMELBERGER, F. APCI VESSEL INSPECTORS YOUER,L. HUBBS, M. H. 990003020 ULATIONS 061500066 990605220 068100066 005500066 080100066 990004220 990001290

OLLS- MOBILI-DIE-105 TEXACC-CAPPELLA-AA CELLULUBE-550 FLUUROLUBE SEARS-THKEAD-CUTTIN OUTLET AND INLET CONNECTIONS CGA-PAMPHLET-V-1 57P 1965 OUTLET AND INLET CONNECTIONS CSA-896 57P 1965 OUTLET AND INLET CONNECTIONS ASA-857*1 57P 1965 APL-SAFETY-DEPT-R APCI-IWO-NO-69-1034 IP 11/6/63 CVERPRESSURE APCI-IIA-1 2P 2/18/72 GVERPRESSURE INTEGRITY UF INSULATIO% SHUP FABRICATED UX STURAGE TANKS APCI-GVERPRESSURE INTEGRITY OF INSULATION FIELD FAB≺IC⊅TÉD″ FLAT-BOTTOM LOX STORAGE OIL ANALYSIS APCI-ANAL-REP-63-1662 AND 1663 APCI-IWD-ND-69-1034 IP 11/6/ OIL-CONTAMINATION UF STAINLESS-STEEL SURFACES EXPOSED TO GASEOUS DXYGEN APL OILS TO THEIR OXYGEN-COMPATIBILITY AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND APCI-ANAL-KEP-61-435 OCCURRED IN BURCKHARDT CENTRIFUGAL LUX-PUMP-TYPE-GB114-NU-29224 APL-SAF OCCURRED IN BURCKHARDT CENTRIFUGAL LUX-PUMP-TYPE-GB114-NU-29224 APL-SAF OCCURRED WITH GTHER GXYGEN-EQUIPMENT APCI-IIF3-6 2P 2/3/72 ODCP IAATION OF GAS FEDERAL REGISTER VOL-35 NO-220 11/11/70 OIL CONTENT AND FLAMMABILITY TEMPERATURE APCI-MEMO-59 12/11/59 1P OIL FROM ALIQUIPPA PUMP-SUCTION FILTER DEFKOST AND OF METHYLENE-CHLORIDE DIL ANALYSIS APCI-ANAL-REP-63-1662 AND 1663 APCI-IMO-NO-69-1034 1P APCI-SAFETY-STD-625.0.1.2 3P 4/9/71 CXCMAT FLAMMABILITY IN 100-PERCENT GASLOUS GXYGEN APL-C-155/9.5 33P 1971 10 2/21/72 APC 1-1424-10 OCCUPATIONAL NOISE **OVERHAUL PRUCEDURE** OXCMAT APCI INDUSTRIAL-SAFETY-GAS CYLINDER VALVE GAS CYLINDER VALVE 990605410 APCI OPERATIONAL-HAZARDS-OPERATIONAL-HAZARDS-OPERATIONAL-HAZARDS-990004560 S AND THREADING COMPOUNDS-GAS CYLINDER VALVE DAVIES, G. APL 990002350 RESSED 990002370 KESSED 990002360 RESSED 990065420 APCI 990003250

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MITH DAYGEN COMBUSTION IN OXYGEN AND SOXHLET FIRE FOR THE CALLOR OF THE 
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DXYGEN IV NASA-TMX-53773 50P 8/23/68

DXYGEN IV NASA-TMX-53773 50P 8/23/68

DXYGEN IV NASA-TMX-53773 50P 8/23/68

DXYGEN OWPATABILITY WITH TWG-PART EPGXY-COMPOUND (7343-RESIN- 7139-CATALYST) FR

CXYGEN DIFFUSION IN THE ATMOSPHERE FROM LIGUID OXYGEN PUOLS ADVANCES IN CPYC

CXYGEN DIFFUSION IN THE ATMOSPHERE FROM LIGUID OXYGEN PUOLS GGA AIR-SEPARATI

CXYGEN DIFFUSION IN THE ATMOSPHERE FROM LIGUID OXYGEN PUOLS GGA AIR-SEPARATI

CXYGEN INDEX RATING VITON-CI-RING MATERIAL VITON-E-60 (GREEN) VITON-A (BLACK) G

CXYGEN SERVICE APCI-550-S0-274 5P LZ/10/59

CXYGEN SERVICE -20F TO 100F 500-PSIG-MAX-CNG CARBON-STEEL APCI-DES-ENG-STO-578.6
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              GXYGEN CUMPRESSION SYSTEM EL/SEGUNDO/CALIF APCI-CONSTR-SPEC-200.0 TG 200.20 20 OXYGEN COMPRESSOR FIRE APCI-SAFETY-GRAM-NO-03 2P 7/7/61 OXYGEN COMPRESSOR FIRE AI SSPC ROGNAC PLANT 3/2/71 APL-SAFETY-BULL-107 3P 4/1 OXYGEN COMPRESSOR MANUAL HATTINGEN PLANT 15P APPENDIX I II III 8P OXYGEN COMPRESSOR SUCTION APCI-MEMO-71 07/26/71 2P CXYGEN COMPRESSOR SYSTEM APCI UPERATED APCI-DES-ENG-STO-570.7 32P 7/19/71
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720-PSIG-MAX CARBGN-STEEL APCI-06S-ENG-STD-578.6
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                                                                                                                                                                                                                                                                                                                                                                                                                  G 7P PLUS 9P FIGURES PRESENTED BY CRYDGENIC ENGINEFRING CONFERENCE GARLUCK-900 APCI-ANAL-REP-70-026
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BLACK) VITON-E60 (GREEN) DEMAG-LETTER TC APCI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   AIR AND AMMONIA
                                                                                                                                                                                          REVISED 1/31/68
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  APCI PIPING- DATUGEN CUMPRESSOR LOCATION APCI-DES-ENG-STO-570.6 2P 1/15/11

APCI PIPING- DXYGEN COMPRESSOR LOCATION APCI-DES-ENG-STO-570.6 2P 1/15/11

DEMAG KA-27-1V/KA-4-IV DXYGEN COMPRESSORS VITON-A (BLACK) VITON-E60 (GREEN) DEMAG-LET

LD TESTING AND CENTRIFUGAL DXYGEN COMPRESSORS APCI-DES-ENG-STD-551.2.8.1 14P 2/3/71

TESTING AND RECIPROCATING DXYGEN COMPRESSORS APCI-DES-ENG-STD-551.1.9.1 14P 2/3/71

F. APCI NOTES ON LIQUID DXYGEN CONTAMINANTS MISSILE-FROGRAM 10P 1/6/58

APCI DXYGEN CONTAMINANTS MISSILE-FROGRAM 10P 1/6/58

APCI DXYGEN CONTROL-PANEL APCI-DES-ENG-STD-534.1 (TO BE PUBLISHED)
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       6/1/62
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   720-PSIG-MAX CARBON-STEEL 150-PSIG-MAX CARBON-STEEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          2 P
                                                                          APCI-IMO-NO-10-0858
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CH-MANUAL SAFETY IN
                                                                                                                                                                               APCI-SAFETY-GKAM-ND-54C 6P 1/31/67 P6
APCI-SAFETY-GRAM-NU-23C 6P 1/10/63
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   OXYGEN CYLINDER FAILURE APCI-SAFETY-GRAM-NG-13
OXYGEN FIRES AICHE-CEP-TECH-MANUAL SAFETY IN
                                                                                                            P152 1P 1/63
P3 1P 6/63
                                                                                                                                                                                                                                                                                                                                                                                                               NATIUNAL SAFETY! CUNGRESS CHICAGG
USAF-CONTRACT-AF33(616)6730 14P C
                                                                                                                                                                                                                                                          OMIC-REPORT-224 33P PLUS APPENDIX
MTP-P+VE-M-63-14 94P 12/4/63
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                                                                                                                                                                                                                                                                                                                                        NASA-TMX-53052 34P 5/26/64
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DMIC-REMO-163
                                                                                                                                                                                                                                                                                                                                                                             NASA-TMX-985 72P 8/64
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                                                                                                               APC I-R+D-NO TESOOK-111
                                                                                                                                                    APC 1-R+D-NUTEBOOK-130
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       1001
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                                                                       APCI-ANAL-REP-61-435
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                                                                                                                                                                                                                                                                                                                                                                                                               DXYGEN
OXYGEN
                                                                                                                                                                                                                                                                                     9900C1280 Y GF MATERIALS WITH LIQUID DXYGEN 990001240 Y UF MATERIALS WITH LIQUID DXYGEN 990001270 Y GF MATERIALS WITH LIQUID DXYGEN
                                 CXYGEN
                                                                       CXYGEN
                                                                                                                                                 DXYGEN
                                                                                                                                                                               990G00170 CHMUYER,W.W. APCI LIQUID OXYGEN
990GG0070 HMOYER,W.W. APCI GASEGUS GXYGEN
                                                                                                                                                                                                                                                          UTE IGNITION OF METALS'IN DXYGEN
                                                                                                            CXYGEN
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                              7500-PS1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    ON AND EQUIPMENT ERECTION
                       990005960 F MATERIALS WITH 7500-PS1 990001210 Y IN 100-PERCENT GASEDUS
                                                                                              990001220 Y TESTS WITH HIGH-PRESSURE 990001230 Y TESTS WITH HIGH-PRESSURE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         990002910 G OF SCREENS TO BE USED IN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            990001250 Y OF MATERIALS MITH LIQUID 990001260 Y OF MATERIALS MITH LIQUID 990005950 APCI BURNING OF METALS IN 990003120 L.6. LATSHAW, D.R. APCI
                                                                                                                                                                                                                                                                                                                                                                                                               990002190 E-FLUIDS AND HIGH-PRESSURE 990003030 INING LIQUID AND GASEGUS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 990003860 ANBA,J.S. APL BURCKHARDT
990004100
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               APCI PIPING-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           990000270 LD TESTING AND CENTRIFUGAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             990003350 IFICATION FOR CLEANING FOR
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              FLOW ING
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          BALL, W. L. APCI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            990002620 AGRICULTURAL CHEMICAL CO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SCHMUYER, W. W. APCI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 MASTER, H.H. APCI
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990006000 PIN,A,
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R GXYGEN SERVICE PRESSURE-VESSEL FABRICATION APL-ENGR-SPEC-C.04 BP 7/26/71
S GXYGEN SERVICE VESSEL FABRICATION APL-ENGR-SPEC-C.04 BP 7/26/71
S GXYGEN STURAGE CYLINDER APCI-DES-ENG-STD5.1.3 3P 10/17/60
OXYGEN STURY PROJECT 00-1-2495.07 APCI-DES-ENG-STD5.1.3 3P 10/17/60
OXYGEN TRAILER FIRE AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS V CXYGEN TRANSFER EQUIPMENT MALFUNCTIONS AND FAILURES COMPRESSURS AND PUMPS APCI-OXYGEN TRANSFER EQUIPMENT MALFUNCTIONS AND FAILURES COMPRESSURS AND PUMPS APCI-OXYGEN-COMPATIBILITY AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS CXYGEN-DISPERSAL FROM VENTS AND LINES APCI-IIF2C-I IP 6/22/71
OXYGEN-EQUIPMENT APCI-IIF3-6 2P 2/3/72
OXYGEN-EQUIPMENT AND SYNTENS AUTONICE APCI-IIF2C-I IP 6/22/71 OXYGEN PUMP ALCHERUCTILCUTHANDL JOINT STATEMENT OXYGEN PUMP EXPLOSION AIRCO-BUTLER APCI-MEMO-63 10/21/63 IP PLUS 6P ATTACHMEN OXYGEN PUMP FAILURES AICHE-CEP-TECH-MANDAL SAFTY IN AIR AND AMMONIA PLANTS OXYGEN PUMP FAILURES RE-99000301

OXYGEN PUMP FAILURES RE-99000301

OXYGEN PUMP FILTER ASSEMBLY APCI-DRAWING-5852IC REV-B 12/16/57

OXYGEN PUMP FAILURE SECONDE FUR ANALYTICAL PURPCSES APCI-PUM-SEC-1.07 SP 7/
OXYGEN REGULATORS IN THE WELDING INDUSTRY APCI-SAFTY-GRAM-NU-60C SP 11/26/67

OXYGEN REGULATORS T-FILM APCI-MEMC-61 11/30/61 LP

OXYGEN SAFETY REVIEW DATA- ACCIDENT/INCIDENT INVESTIGATION AND REPORT-APCI DOCUME OXYGEN SAFETY REVIEW CHECK-LIST APCI-MEMO-71 3P

OXYGEN SAFETY REVIEW CHECK-LIST APCI-MEMO-71 3P

OXYGEN SERVICE APCI-PUM-SEC-1.08 7P PLUS 9P ATTACHMENTS

I UXYGEN SERVICE APCI-QUAL-CONT-LAYOUT-102F 3P 7/1/11

OXYGEN SERVICE APCI-GUAL-CONT-LAYOUT-102F 3P 7/1/11 CXYGEN PIPELINES APLENGE-SID-LS.30/1 BP 7/1/70
CXYGEN PIPELINES APLENGE-SID-LS.30/1 BP 7/1/70
CXYGEN PLANT AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS V-5 PICXYGEN PLANT EXPLOSION AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA
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CXYGEN PUMP AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA
CXYGEN PUMP AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA
CXYGEN PUMP SXPLOSION AIRCO-BUTLER APCI-MEMO-63 10/21/63 IP PLUS 6P ATTACHMEN 990001890 Y OF MATERIALS WITH LIQUID OXYGEN METHYL-CHLORIDE, METHYLENE-CHLORIDE, CHLOROFGRM, ETHYL-CHLORIDE, DICHLOROETH 990002640 MASTER,H.H. APCI OXYGEN PIPE-LINE FAILURE APCI-MEMO-67 12/29/67 IP NFPA-NU-51 8P 1969 AND CUTTIN AMENDMENTS TO APL-SAFETY-BULL-114 3P 7/13/71 -L8-0043 APC1-TM-112 6P 5/8/69 990000280 APCI PIPING NXYGEN-PIPING APCI-DES-ENG-STD-578.60.1 14P 4/24/12 AND TYPE-X-15 990000710 ITY AND EXPLOSION HAZARDS- GXYGEN-PRESSURE-GAUGE TWF WOOL, SPINTEX-365, MOLYKUTE-TYPE-Z AND TYPE-X-15 OXYGEN PIPE-LINE FAILURE APCI-MEMO-67 12/29/67 IP OXYGEN PIPELINE DESIGN CONCEPTS AND CRITERIA APCI-11F2-2 IP 2/21/72 GXYGEN-EQUIPMENT AND SYSTEMS WHICH CAUSED INJURY TO PERSONNEL OR EXYGEN-FUEL GAS SYSTEMS FOR WELDING AND CUTTING NFPA-NO-51 8P 19 GXYGEN-LINE APCI-SAFETY-GRAM-NO-05 IP 10/20/01 CXYGEN-LINE APL-SAFETY-BULL-028 IP 1/68 SITES PROPUSED AMENDMENTS PART II APL-ENGR-SPEC-E.34 12P 6/1/71 COMPRESSURS APL-ENGR-SPEC-K.02 3P 6/23/69 (APL-PLANIS) APL-ENGR-SPEC-E.04 12P 6/1/7) APCI-SAFETY-SID-629.0.10 IP 6/19/61 APCI-SAFETY-SID-608.1 7P 10/65 APL-ENGR-SPEC-L.12.1 2P 7/7/09 NFPA-NO-566 APCI LIGUID OXYGEN LCADING APCI-SAFETY-GRAM-NO-06 IP 11/17/61 APC1-1W0-N0-L8-0043 APL-ENGR-SPEC-J.07 3P 6/18/69 APL-ENGR-SPEC-E.05 13P 6/1/71 APL-ENGR-SPEC-J.15 3P 6/18/69 CGA-PAMPHLET-G-4.1 21P 3/59 S1TES-1965 DXYGEN-LINE AT A CYLINDER FILLING DEPOT MAB-3268-69 SYSTEMS AT CONSUMER SYSTEMS AT CONSUMER OXYGEN-NITROGEN-ATMOSPHERES 17P 1/60 SYSTEMS OXYGEN SERVICE GXYGEN SERVICE OXYGEN SERVICE OXYGEN SERVICE OXYGEN SERVICE OXYGEN SERVICE DXYGEN SERVICE DXYGEN SERVICE **OXYGEN SERVICE** DXYGEN SERVICE **CXYGEN SERVICE** OXYGEN OXYGEN OXYGEN 990005690 "HICH OCCURED WITH OTHER OX 990005920 PURIS ACCIDENTS INVOLVING UX 990005920 FURIS ACCIDENTS INVOLVING UX 9900060020 KITSON,F.K. APCI FIRE IN 0X 990003870 IN HIGH-PRESSURE GASEDUS UX 990001870 -LIMITS GF CARBON STELL IN OX 990001900 SSGC INSTALLATION OF BULK 990001910 SSGC INSTALLATION OF BULK RECONSTRUCTED ICI TONNAGE MATHEWS, L.G. LINDE ROTZLER, K.W. ET. AL 990002970 FOUNDRIES AND STEEL LID 990003000 NERCY RELEASE IN A LIQUIC 990003610 W. APL SPECIFICATION FOR 990003660 W. APL SPECIFICATION FOR COMPATIBILITY FOR GASEUUS 990005510 ELINE TRANSPORTATION- APL 990003010 RENDOS, J.J. AIRCG LIQUID 990002630 RENDUS, J.J. AIRCG LIQUID APCI BYRUN-JACKSON 990001100 ON,F.K. APCI ASSEMBLY UF 990005940 APCI LIQUID AND GASEOUS 990000940 N,F.K. APCI CLEANING FUR 990000950 PMENT IN AIR PLANTS AND IN 990000780 -TUBE TYPE GAUGES USED FUR 990000540 S- DEVIATIONS CLEANING FOR 990000500 INSPECTION- MATERIALS AND 99000376C AND DISCHARGING MANIFULUS 990003720 J.W. APL PRESSURE-GAUGE-990003700 AND TUBE-TYPE-COOLERS FOR 990003730 SURE REGULATING-VALVES FOR 990001950 SOC EQUIPMENT CLEANED FOR 990000960 R.E.J. APCI CLEANING FOR 990003630 ASING ACCEPTANCE TESTS FUR 990003690 YPE-COOLER, OTHER THAN FUR 990003070 D-DXYGEN PUMPS ALUMINUM IN PRESSURE-VESSELS- GASEDUS SCHMOYER, W.W. APCI NASA 990005700 APCI OPERATIONAL-HAZARDS-GASECUS 99G002010 E GF CUTTING DILS TO THEIR 990005640 D PIPELINE TRANSPORTATION 990002610 BALL, W.L. APCI REPURT OF 990002990 TIGNAL CYLINDER GAS CO SCHMOYER, W. W. APCI APCI LATSHAM, D.R. APCI PEGRAM, Joho APL 990003450 RACTICES USED FOR KITSON "F"K" 9900C2630 RENDUS, J.J. 99000069 990001030 026500066 091000066 990003400 990302170 990004040 990002980 990002960 990002660 051000066

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PACKINGS—VALLEGREEN, VALLEY/FORGE GASKET CO APCI-LASA-03 IP 2/21/72
PACKINGS—VULCANIZED—RED—FIBRE—GASKETS APCI-LASA-08 IP 2/21/72
PACKINGS—VULCANIZED—RED—FIBRE—GASKETS APCI-LASA-08 IP 2/21/72
PAINT SYSTEMS APCI-QUAL—CONT—LAYOUT—120F 3P 7/1/71
SYSTEMS APCI-QUAL—CONT—LAYOUT—120F 3P 7/1/71
PAINTING—COLD—BOXES THERMAL TANKS PERLITE APCI-LOES—ENG—STD—581.3 IP 10/24
PAINTING—COLD—BOXES THERMAL TANKS GASS WULL APCI-DES—ENG—STD—581.2 2P
PAINTING—COLD—BOXES THERMAL TANKS GASS WULL APCI-DES—ENG—STD—S81.2 2P
PAINTING—COLD—BOXES THERMAL TANKS FAILTY APCI-MEMO—71 1/01/26/71 2P
PACKING APCI-MEMO—61 11/28/61 2P
PENTON APCI-MEMO—61 11/28/61 2P
PENTON APCI-MEMO—61 11/28/61 2P
PENTON APCI-MEMO—61 11/28/61 2P
PENTON T—FILM—THREAD COMPUND APCI-MAR—87—0821 IP 11/61
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Y IN 100-PERCENT GASECUS GXYGEN FOAMSEAL-30-45-LIQUID, FOAMSEAL-30-45-DRY, FLEXFAS-82-10-LIQUID, FLEXFAS-82 OMPONENTS- AIR-SEPARATION, GXYGEN, COMPRESSOR APCI-SAFETY-STD-607.1.2.3 6P 12/62
RSON:1. APL EXPLOSION ON OXY-FUEL-BURNER EQUIPMENT AT ALCAN-BOOTH ALUMINIUM WORKS ROCERSTONE/NEWPORT 5/18
L.G. LATSHAM:0.R. APCI GXY-TITE THREAD COMPOUND APCI IMO-NO-XD-0134 APCI-ANAL-REP-71-336 1P 10/22/71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                PACKINGS- KLINGERIT-661 RICHARD KLINGER LTD/UK
PACKINGS- KM220-SHEET ASBESTUS GASKET MATERIAL NICULET INDUSTRIES INC APCI-1A5A
PACKINGS- KM246 SHEET-ASBESTUS GASKET MATERIAL NICULET INDUSTRIES APCI-1A5A-09
PACKINGS- MELRATH-150 (SHEET-ASBESTUS GASKET MATERIAL) APCI-1A5A-05 IP 2/21/7
PACKINGS- SINDANYU CS-51-ASBESTUS AND CEMENT BOARDS, NATURAL-UNTREATED-FINISH TUR
PACKINGS- TEFLUN, DUPGNI APCI-1A5A-10 2P 2/21/72
                                                                                EQUIPMENT MALFUNCTIONS AND FAILURES GAS-PRESSURE-REGULATORS
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PACKINGS- TEFLON, DUPGNI APCI-1A5A+10 2P 2/21/72
PACKINGS- TFE-GF-GREEN, NELRAIH GASKETS CO APCI-1A5A-02 1P 2/21/72
PACKINGS- TFE-GF-GREEN, NELRAIH GASKETS CO APCI-1A5A-02
PACKINGS- TYGAFLGR CEMENTABLE PTHE TAPES TYGADURE LTD/UK APCI-1A5A-14
PACKINGS- TYGAFLGR CAMENTABLE OTHE CO APCI-1A5A-03 1P 2/21/72
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PACKINGS- GARLOCK-900 (SHEET-ASBESTUS SASKET MATERIAL) GARLOCK MFG CO.
PACKINGS- GRAPHITE-IMPREGNATED-ASBESTUS-PACKING. APCI-IA5A-01 IP 2/21/7
                                                     3/22/63
                                                  APCI-SAFETY-GRAM-NO-27 5P
             APC I - DES-ENG-STD-546.1
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NEL PROTECTIVE SHIELDS AND S AND THREAD COMPOUNDS FOR
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PHENOLIC RESIN, CUTIING-OILS, HEXADECANE, HYDROCARBON TYPE CUTTING-OILS, KNOWN AS T PHENOLIC-MOLDED, MELAMINE-MOLDED, POLYESTER-GLASS, NYLON, MOLYBOENUM-DISULFIDE, GRA PICKLING OF CARBON-STEEL PIPE AND FITTINGS APCI-CONSTR-SPEC-200.16.1.7 TO 200
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             PIPE-LINE FAILURE APCI-MEMO-67 12/29/67 1P
PIPELINE DESIGN CONCEPTS AND CRITERIA APCI-11F2-2 1P 2/21/72
PIPELINE TRANSPORTATION VEHICLE ACCIDENT PROCEDURES APCI-11F20-1 1P 8/22/71
PIPELINE TRANSPORTATION OXYGEN-DISPERSAL FROM VENTS AND LINES APCI-11F2C-1 1P
PIPELINE TRANSPORTATION OXYGEN-DISPERSAL FROM VENTS AND LINES APCI-11F2C-1 1P 8/PIPELINE TRANSPORTATION LIST STANDARDS APCI-11F2-1 2P 2/18/72
PIPELINE TRANSPORTATION-LIST STANDARDS APCI-11F2-1 2P 2/18/72
PIPELINE TRANSPORTATION-LIST STANDARDS ESTABLISHMENT OF MINIMUM STANDARDS F PIPELINE MINIMUM FEDERAL SAFETY-STANDARDS FILING OF INSPECTION AND MAINTENANCE PLOFILINE-MINIMUM FEDERAL SAFETY-STANDARDS FILING OF INSPECTION CONFROL FE PIPELINE-MINIMUM FEDERAL SAFETY-STANDARDS MISC AMENDIANTS FOR CONFIRMATION OR PIPELINE-MINIMUM FEDERAL SAFETY-STANDARDS EXTENSION OF TIME FOR CONFIRMATION OR PIPELINE-MINIMUM FEDERAL SAFETY-STANDARDS STANDANDS TIME FOR CONFIRMATION OR PIPELINE-MINIMUM FEDERAL SAFETY-STANDARDS WISC AMENDIANTS FOR CONFIRMATION OR PIPELINE-TRANSPORTATION PIPELINE TRANSPORTATION—APL OXYGEN PIPELINE DESIGN CONCEPTION-LIFE-INFERINE TRANSPORTATION—INSTANDARDS APCI-11F2-1
                                                          990004480 ING COMPOUNDS- TEFLON-TAPE PERMACEL APCI-IAZA-02 2P Z/21/72
990001110 MICAL CO-CHESTERTUWN-MD., PERMACEL-RIBBON-UOPE PERMACEL-NEW/BFUNSWICK/NEW/JERSEY, WEST CONCRETE FLOOR TREATM
990001160 FRIESLAND-PLASTIC COMPANY, PERMACEL-TAPE APCI-ANAL-REP-60-495.61-3 APCI-IWO-NO-81-0018 IP 1/16/61
990001130 THREE-M-FLUCROCARBON-TAPE, PERMACEL-TAPE APCI-MEMU-63 07/30/63 IP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                         APCI-SAFETY-STD-627.4
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        PICTURIAL SURFACE PREPARATION STANDARDS FOR PAINTING STEEL SURFACES ASTM-D2230-PINE AND MAPLE WOOD, ACTIVATED CARBON APCI-MAR-87-0-8821 IP 10/61
PIPE AND FITTINGS, CLEANING ALUMINUM-PIPE FITTINGS PARTS AND FABRICATIONS, CLEANIPPE BURNING TESTS APCI-R+O-NUTEBOOK-111 P26-9 4P 4/17/61
PIPE THREAD SEALANTS APCI-DES-ENG-STO-570,5,1 IP 11/11/60
                                                                                                                                                                                                                                                                                                                                                                                                                                   APCI-TB-42 3P 9/30/71 APPLICA
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 PERSONNEL-PROTECTIVE-EQUIPMENT TONNAGE AIR-SEPARATION PLANT APCI-SAFETY-STD-627。
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                                                                                                                                                                                                                                      APC1-K+0-NO
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                                                                                                                                                                                                                        990001220
BEROPHY### APCI PERMATEX SEALANT-1516- COMPATABILITY TESTS WITH HIGH-PRESSURE GXYGEN APCI-64-6
990004470 S AND THREADING COMPOUNDS- PERMATEX-1516 APCI-1A2A-01 1P 2/21/72
990004470 S AND THREADING COMPOUNDS- PERSONAL PROTECTION-EQUIPMENT MAINTENANCE APCI-POM-1.12 7P 4/21/67
990005870 TEM-EMERGENCIES PROTECTION PERSONNEL PROTECTIVE SHIELDS AND UXYGEN-SYSTEMS APCI-DES-ENG-STD-546.1 9P 1
990003280 APCI CIVIL-STRUCTURAL-PROTECTIVE SHIELDS FOR OXYGEN SYSTEMS APCI-16-42 3P 9/30/71 APP
990003200 SMITH**H** APCI PERSONNEL-PROTECTIVE-EQUIPMENT- EXE PROTECTION APCI-SAFETY-STD-6
990003160
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         PIPE-COATING THE PLASITE TESTS MANUFACTURED BY PITTSSURGH CHEMICAL
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PETROLEUM REFINERY PIPING ANSI-B31,3 104P 1966
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APL-ENGR-SPEC-M.62
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                              APCI USE OF PERLITE IN AIR-SEPARATION COLD-BOXES APCI-TB-39 1P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        PIPELINES APL-ENGK-STO-LS.30/1 8P 7/1/70 PIPELINES CURROSIUN-PITTING- NUTICE UF PUBLIC
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APL-ENGK-SPEC-N.01 3P 1/2/70
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      APL-ENGR-SPEC-N. US 5P
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             APL-GCP-G11 REV.O 2P
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ANSI-831.5 60P 1966
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EXPANDED PERLITE
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            990005650 ROAD, RALLRUAD, BARGE AND PI
990005640 ROAD, RAILRUAD, BARGE AND PI
990005600 ER PIPELINE-TRANSPORTATION PI
990005610 ER PIPELINE-TRANSPORTATION PI
990003510 NATURAL AND OTHER GAS BY PI
990003520 NATURAL AND OTHER GAS BY PI
990003540 NATURAL AND OTHER GAS BY PI
990003570 NATURAL AND OTHER GAS BY PI
990003570 NATURAL AND OTHER GAS BY PI
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990003520 NATURAL AND OTHER GAS BY PI
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990003570 NATURAL AND OTHER GAS BY PI
990003530 NATURAL AND OTHER GAS BY PI
990005610 L-HAZARDS- CXYGEN-TRANSFER PI
990005600 L-HAZARDS- CXYGEN-TRANSFER PI
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990006620 DS, AND EXPLOSION TESTING-
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    NECPRENE, EPCXY-ADHESIVE,
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              CLEANING OF CARBON STEEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      990003810 ELLULAR GLASS SECTION FOR 990004040 PEGRAM, J. W. APL OXYGEN
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990003550 L SAFETY-STANDARDS FOR GAS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              990005470 SES CLEANLINESS OF DXYGEN
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052500066
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PCI PIPING— IRANSILIUN—JOINIS AND ALUMINUM IN STAINLESS—STEEL APCI-DES-ENG-STD—579,12 PCI PIPING— VALVE PROCUREMENT AND CLEANING PROCEDURE APCI-DES-ENG-STD—579,5 3P 8/1 PCI PIPING—AA1.2—COLD—BOX—SERVICE 100F AND BELOW 150—PSIG—MAX—DNG ALUMINUM APCI-DES-ENCIPPING—AA3—COLD—BOX—SERVICE 100F AND BELOW 300-PSIG—MAX—DNG ALUMINUM APCI-DES-ENCIPPING—CSI4—GENERAL—SERVICE 100F AND BELOW 300-PSIG—MAX—DNG CARBON STEEL—PIPE PCI PIPING—CSI4—GENERAL—SERVICE 20F TU 100F 150-PSIG—MAX—DNG CARBON STEEL—PIPE PCI PIPING—CS20—GENERAL—SERVICE 20F TU 100F 276-PSIG—MAX—DNG CARBON STEEL—PIPE PCI PIPING—CS20—GENERAL—SERVICE 20F TU 100F 276-PSIG—MAX—DNG CARBON STEEL—PIPE PCI PIPING—CS20—GENERAL—SERVICE 20F TU 100F 3600-PSIG—MAX—DNG CARBON STEEL—PIPE PCI PIPING—CT2—COLD—BOX—SERVICE 20F TU 100F AND BELOW 400-PSIG—MAX—DNG CARBON STEEL—PIPE PCI PIPING—CT2—COLD—BOX—SERVICE—PCI PIPING—OF SIG—MAX—DNG CARBON STEEL—PIPE PCI PIPING—OF SIG—MAX—DNG CARBON STEEL—PIPE PCI PIPING—IA44—COLD—BOX—SERVICE—PROCESS—INSTRUMENT—PIPING 100F AND BELOW 900-PSIG—MAX—DNG CARBON STEEL—PIPING—IA44—COLD—BOX—SERVICE—PROCESS—INSTRUMENT—PIPING 100F AND BELOW 900-PSIG—MAX—DNG CARBON STEEL—PIPING—IA44—COLD—BOX—SERVICE—PROCESS—INSTRUMENT—PIPING—IA44—COLD—SIG—PAX—SERVICE—PROCESS—INSTRUMENT—PIPING—IA44—COLD—PAX—SERVICE—PROCESS—INSTRUMENT—PIPING—IA44—COLD—PAX—SERVICE—PROCESS—INSTRUMENT—PIPING—IA44—COLD—PAX—SERVICE—PROCESS—INSTRUMENT—PIPING—IA44—COLD—PAX—SERVICE—PAX—SIGO
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100F AND BELCW 900-PSIG-M
1P 1/62
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PIPING-SSI2= COLO-BOX-SERVICE 100F AND BELON 1235-PSIG-MAX-DWG STAINLESS STEEL-PI
PIPING-SSI7-COLD-BOX-SERVICE 100F AND BELOW 1715-PSIG-MAX-DWG STAINLESS STEEL-PIP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              APCI-DES-E
APCI-DES-E
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PIPING-SS30- COLD-BOX-SERVICE 100F AND BELOW 3000-PSIG-MAX-OWG STAINLESS STEEL-PI
PIPING-SS36- COLD-BOX-SERVICE 100F AND BELOW 3600-PSIG-MAX-OWG STAINLESS STEEL-PI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           PIPING-SS7.2- COLO-BOX-SERVICE 100F AND BELOW 720-PSIG-MAX-OWG STAINLESS STEFL-PIPP PIPING-SSLI.5-100BE-OIL-SERVICE --20F TO 150F 150-PSIG-MAX STAINLESS STEEL-PIPP
PIPING SYSTEMS AND TO THE TOTAL OF THE TOTAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             PRESSURE RATING TABLES- PLAIN-AND-THREADED-ENDS- RED BRASS-PIPE APCI
PRESSURE RATING TABLES- PLAIN-AND-THREADED-ENDS- CARBON STEEL-PIPE A
PRESSURE RATING TABLES- PLAIN-AND-THREADED-ENDS- STAINLESS STEEL-PIPE
PRESSURE RATING TABLES- PLAIN-AND-THREADED-ENDS ALUMINUM-PIPE APCI-D
PRESSURE RATING TABLES- PLAIN-ENDS COPPER-TUBE APCI-DES-ENG-STD-574.
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PLASITE—NG-7122H APCI-MAR-87-0-8820 IP 6/60
PLASITE—NG-7122H WISCONSIN PROTECTIVE CGATING CG APCI-IA6A-03 IP 2/21/72
PLASITC—NG-7122H WISCONSIN PROTECTIVE CGATING CG APCI-IA6A-03 IP 2/21/72
PLASITG APCI-MAR-87-0-8821 IP 6/62
PLASITG EAD TOMERS, AND ADHESIVES—REVENE—BINDER APCI-IA4A-02 IP 2/21/72
PLASITGS, ELASTOMERS, AND ADHESIVES—RIV-60, SILICUNE—RUBGER CUMPOUND WITH SS-4004-PLASITGS, ELASTOMERS, AND ADHESIVES—NEUPRENE APCI-IA4A-05 IP 2/21/72
PLASITGS, ELASTOMERS, AND ADHESIVES—NEUPRENE APCI-IA4A-06 IP 2/21/72
PLASITGS, ELASTOMERS, AND ADHESIVES—NEUPRENE APCI-IA4A-05 IP 2/21/72
PLASITGS, ELASTOMERS, AND ADHESIVES—NEUR APCI-IA4A-04 IP 2/21/72
PLASITGS, ELASTOMERS, AND ADHESIVES—NEUR APCI-IA4A-04 IP 2/21/72
PLASITGS, ELASTOMERS, AND ADHESIVES—NEUR APCI-IA4A-04 IP 2/21/72
PNEUMATIC TESTING-GENERAL APCI-QUAL-CONT-LAYDUT-105A 3P 7/1/71
                                                                                                                                                                                                                                                                                                  COMPONENTS— AIR—SEPARATION, GXYGEN, COMPRESSOR APCI—SAFFTY—STD—607.1.2.3 6
COMPONENTS— AIR—SEPARATION, GXYGEN, COMPRESSOR APCI—SAFFTY—STD—607.1.2.3 6
COMPONENTS— AIR—SEPARATION PLANT, PIPING, VALVES AND SAFETY—FELIEF DEVICES
COMPONENTS— AIR—SEPARATION PLANT, CRYGENIC—LIQUID, AND DISPOSAL APCI—SAFET
COMPONENTS— COLD—BOOXES APCI—SAFETY—STD—607.1.5 TP 1/63
COMPONENTS— STORAGE, CONVERTER—SYSTEM, AND COMPRESSED—GASES APCI—SAFETY—ST
COMPONENTS— STORAGE, VACUUM—SYSTEMS, AND COMPRESSED—GASES APCI—SAFETY—ST
COMPONENTS— STORAGE, VACUUM—SYSTEMS, AND COMPRESSED—GASES APCI—SAFETY—ST
COMPONENTS— STORAGE, VACUUM—SYSTEMS, AND AMMONIA PLANTS V—3
EXPLOSION AICHE—CEP—TECH—MANUAL SAFETY IN AIR AND AMMONIA PLANTS V—4
MANAGERS SAFETY MEETING—CREIGHTON/PENNSYLVANIA 19P 2/28/68/AND 3/20/68
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             990000760 ITY AND EXPLOSION HAZARDS- PLANT-WASH-DUT STUDIES CELLULUBE-300 CELLULUBE-220 APCI-MAR-87-0-8822 IP 7763 9900000740 ITY AND EXPLOSION HAZARDS- PLANT-WASH-DUT STUDIES CELLULUBE-300, DTE-103, CELLULUBE-200 RECENT FIRES AT DUPGNT 9900000750 ITY AND EXPLOSION HAZARDS- PLANT-WASH-DUT STUDY CELLULUBE-300, DTE-103, RECENT FIRES AT DUPGNT-NEW/JOHNSONVILL 9900002950 SAFETY IN AIR AND AMMONIA PLANTS AICHE-CEP-IECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS V-2 PP31-36
                                                                                                                                                                                                                                    APC1-DES-ENG-STD-578.30.1 7P 5/62
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                                                                                                                                                                  APCI-DES-ENG-STD-578.10.1 6P 10/65
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ZP CU APCI-R+D-NOTEBOOK-111
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PLANT VAPORIZER EXPLOSION AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA
PLANT WASH-OUT STUDIES, CELLULUBE-300, CELLULUBE-220 APCI-MAR-87-0-8822 ZP
PLANT-LAYGUT APCI-SAFETY-STD-605.1.3 6P 1/6/61
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      990000990 CTION FOR EQUIPMENT IN AIR PLANTS AND IN CXYCEN SERVICE APCI-POM-SEC-1.08 7P PLUS 3P ATTACHMENTS APONCO990 CTION FOR EQUIPMENT AND PLANT, BAND IN CAVOENT WASHOUT-FREQUENCIES APCI-POM-SEC-5.07 9900000950 APCI-SAFETY-STD-607.1.20 3P 4/62 990000450 COMPONENTS- AIR-SEPARATION PLANT, PIPING, VALVES AND SAFETY-ELIEF DEVICES APCI-SAFETY-STD-607.1.20 3P 4/62 990000750 EN AS A LUBRICANT, TARSET, PLASITE PROI-FCTIVE COATING APCI-MEND-60 06/9/60 2P BACI-MAR-87-0-8821 1P 7/62 CP BACI-SAFETY-STD-607.1.12 990001500
                                                                                                                                                                                                 APCI-0ES-ENG-STD-572.1 5P 5/62
                                                                                                                            PLAIN-AND-THREADED-ENDS ALUMINUM-PIPE APCI-DES-ENG-STD-571.1 5P 10/65
PLAIN-AND-THREADED-ENDS- CARBON STEEL-PIPE APCI-DES-ENG-STD-578.10.1 6P
PLAIN-AND-THREADED-ENDS- RED BRASS-PIPE APCI-DES-ENG-STD-572.1 5P 5/62
PLAIN-AND-THREADED-ENDS- STAINLESS STEEL-PIPE APCI-DES-ENG-STD-578.30.1
PLAIN-ENDS COPPER-TUBE APCI-DES-ENG-STD-578.30.1
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PLANT-SITE APCI-SAFETY-STD-610.1.1 5P 11/28/60
PLANT-SITE APCI-SAFETY-STD-610.1.1 5P 11/28/60
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                                                                                                PITTSEAL-III-LIQUID, PORCUS-INSULATING-MATERIAL FOAM GLASS
                            P129-32
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                                                              APCI-1A3A-01 1P 2/21/72
                               APCI-R+D-NOTE2 COK-111
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990000560 HOUSING, AND RUBBER-HOSES PLASITE-NO-7122H APCI-MAR-87-0-8820 IP 6/60
                                                                 PITISBURGH-CORNING COKP
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                               ITE TESTS MANUFACTURED BY LLULAK-6LASS! INSULATION,
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                                                                                                SEALFAS-MASTIC-31-97-DRY,
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TARSET
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POLYMERS, POLYSULFIDE-SEALER, BUNA-N, NEOPRENE, EPOXY-ADHESIVE, PHENOLIC-MOLDED, ME POLYSULFIDE-SEALER, BUNA-N, NEOPRENE, EDUXY-ADHESIVE, PHENOLIC-MOLDED, MELAMINE-MOLPOLYIEIRAFLUOROETHYLENE, IEFLON, POLYTRICHLOUROVINYLCHLORIDE, KEL-F, POLYHEXAFLUORO
                                                                                                                                                                                                                                                                    POLYURETHANE FUAM (EPON-FDAM-H-60) APCI-MAR-87-0-882G IP 8/61
POLYURETHANE-FUAM-INSULATION, RAYBESTUS-MANHATTAN-PACKING, AND IMPREGNATED ASBESTG
POLYVINYLCHLORIDE, PLASTIC LEAD SEAL-NO-2-JOHN CRANE APCI-MEMO-59 01/28/59 2P
POLYVINYLCHLORIDE, POLYETHYLENE-TEREPHTHALATE, MYLAR, POLYTETRAFLUGROFTHYLENE, TEFL
                                                                                                                                                                                                                                                                                                                                                                                                          PORDUS-INSULATING-MATERIAL FOAM GLASS APCI-ANAL-REP-61-034 TO 61-40 AND 61-42 PORTABLE FIRE-EXTINGUISHERS APCI-POM-SEC-1.13 SP 3/30/67 PAGESCHE FIRE-EXTINGUISHERS APCI-POM-SEC-1.13 SP 3/30/67 PAGESCHE FEDERAL REGISTER VOL-36 NO-176 9/10/71 PRESSURE FEDERAL REGISTER VOL-36 NO-176 9/10/71 PRESSURE BOMBS PARK-IGNITION, DGW-CORNING FLUORINATED SILICON-DILS, SHELL POLY PRESSURE BOMBS APCI-SAFEIV-GRAM-NO-49 PAGESCHE INDICATORS APCI-SAFEIV-GRAM-NO-49 PAGESCHE INDICATORS APCI-DES-ENG-STO-531.2 SP 10/63 PRESSURE RATING TABLES- PLAIN-ENUS COPPER-TUBE APCI-DES-ENG-STO-574.1 SP 5/62
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PRESSURE VESSELS DIVISION-1 ASME BGILER AND PRESSURE VESSEL CODE SECTION VIPRESSURE REGULATING-VALVES FUR DXYGEN SERVICE APL-ENGR-SPEC-J.15 3P 6/18/69

PRESSURE TESTING APCI-IIIC-1 3P 9/12/71

PRESSURE VESSEL CODE-ADD MERRBLATTER (ENGLISH TRANSLATION) 304P 9/71
                              POLYETHYLENE-LUW-DENSITY, POLYETHYLENE-IRRADIATED, POLYVINYLCHLORIDE, POLYETHYLENE-POLYETHYLENE-POLYETHYLENE, MYLAK, POLYTETRAFLUDROETHYLENE, TEFLUN, POLYTRICHLOUROV
                                                                                                POLYHEXAFLUOROPROPYLENE VITON A VINYLIDEND FLUORIDE, POLYDIMETHYLSILOXANE, FLUORINA
                                                                                                                                                                                                                                      POLYTRICHLOUROVINYLCHLORIDE, KEL-F, POLYHEXAFLUOROPROPYLENE VITON A VINYLIDEND FLUO
POLYURETHANE FOAM (EPON-FOAM-H-60) APCI-MAR-87-0-8820 IP 8/61
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PRESSURE-GAUGE FAILURE SAFETY GLASSES SAVE ANOTHER PAIR OF EYES APCI-SAFETY-GRAM
PRESSURE-GAUGE- OXYGEN SERVICE APL-ENGR-SPEC-J.07 3P 6/18/69
PRESSURE-GAUGES APCI-MEMO-61 08/2/61 4P
POL YETHYLENE-IRRADIATED, POLYVINYLCHLORIDE, POLYETHYLENE-TEREPHIHALATE, MYLAR, POLY
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PRESSURE-VESSEL FABRICATION APL-ENGR-SPEC-C.04 8P 7/26/71
PRESSURE-VESSELS ESSO-REPORT-NJ-EE.266R.70 17P 8/24/70
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PRGTECTION PRGGRAM APCI-MEMO-71 04/7/71 2P PLUS IP ATTACHMENT
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PRESSURE-VESSELS- VAPURIZER AND CRYGGENIC LIQUID DISPOSAL APCI-C
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RATING TABLES- PLAIN-AND-THREADED-ENDS ALUMINUM-PIPE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               APCI-DES-ENG-STD-531,10,2 2P 12/5/61
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                                                                                                                                  990001890 ORGETHANE, TRICHLORGETHANE 990001890 TRICHLORGETHANE POLYMERS,
                                                                                                                                                                                              990001890 LENE-TEREPHTHALATE, MYLAR,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      APCI INSTRUMENTATION-
APCI PROBLEM APCI PIPING-
                           990001890 TONE, KERUSENE, GLYCERINE, 990001890 UIATED, POLYVINYLCHLORIDE,
                                                                                                    990001390 LOURDVINYLCHLORIDE, KEL-F,
                                                                                                                                                                                                                                      990001890 TRAFLUORDETHYLENE, TEFLON,
                                                                                                                                                                                                                                                                                                         990000660 IMSULATIONS STYRUFDAM AND 990001110 -UXIDE, SEAM COMPOUND GEON
                                                                                                                                                                                                                                                                                                                                                                           POL YETHYLENE-IRRADIATED,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  990003810 RAM+J.W. APL INSULATION-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              990003570 AXIMUM ALLUWABLE UPERATING
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                                                                                                                                                                                                                                                                          990000000 INATED SILICON-UILS, SHELL
                                                                                                                                                                                                                                                                                                                                                                                                             990001300 -DRY, PITTSEAL-III-LIQUID,
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APCI OPERATIONS HEARING
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990002550 RELEASE IN A LIQUID GXYGEN PUBLIC HEAKING FEDERAL REGISTER VOL-36 AND LOSS DAYS OF TITLOTHE STATICONE, 990002550 RELEASE IN A LIQUID GXYGEN PUBLIC HEAKING FEDERAL REGISTER VOL-36 AND AMMENIA PLANTS V-5 PP41-42 19 990003550 RELEASE IN A LIQUID GXYGEN PUMP EXPLOSION BUTLER APCI-MEMG-63 10/21/63 IP PLUS 6P ATTACHMENTS 990004510 L. APCI REPSHIGE DAYSEN PUMP EXPLOSION AND TANKER FIRE AT SHEEPRINGE ALLGY CASTINGS LTD APL-MEMG-64 990004210 NTD BURKCHARDT CENTRIFICAL PUMP EXPLOSION AND TANKER FIRE AT SHEEPRINGE ALLGY CASTINGS LTD APL-MEMG-64 990004210 NJJ. AIRCO LIQUID GXYGEN PUMP FAILURES APCI-SAFETY-GRAM-NO-35 IP 10/4/63 IP PLOS 6P ATTACHMENTS V-9 PS 990002310 JJJ. AIRCO LIQUID GXYGEN PUMP FAILURES RE-99000301 AIR AND AMMONIA PLANTS V-9 PS 990002340 AIRCO LIQUID GXYGEN PUMP FAILURES RE-99000301 APCI-SAFETY BY A APCI CASTINGS LIQUID GXYGEN PUMP FAILURES RE-99000301 APCI-SAFETY APCI CASTINGS APCI-MEMG-69 01/24/69 2P PLUS SPEUS IL CENTRIFUGAL CRYDGENIC PUMPS APL-ENGR-SPEC-6.03 14P 4/1/71 5/11-12/71 LIQUID-OXYGEN PUMPS ALUMINUM IN OXYGEN SERVICE LIQUID-CARGONIC-LIQUID-CXYGEN TRAILER- ACCIDENT VI 990001120
990004500 S AND THREADING COMPOUNDS- PUTTI-ROPE ANALYSIS FOR OIL CONTENT AND FLAMMABILITY TEMPERATURE APCI-MEMO-59
990004500 S AND THREADING COMPOUNDS- PUTTI-ROPE NATIONAL GREENHOUSE CO APCI-1A2A-04 IP 2/21/72
990001400 E-F-50, SFBI(40)-SILICONE, PYDRAUL-F-9, DOM-CORNING-4 COMPOUND SILICONE, DOW-CORNING-4X COMPOUND-SILICONE, FAI FIRE TESTS ON CENTRIFUGAL PUMPS FOR LIQUID-OXYGEN CRYOGENICS V-15 PP241-248 8P 6/70 CHAMBERS,J. APL PURCE PRUCEDURE FOR CRYOGENIC LIQUID CONTAINER APL-1GD-ENGR-MAN-52-02 7P 9P 1/15/71 6P 1/15/70 990000250 IVIL-STRUCTURAL- PERSONNEL PROTECTIVE SHIELDS AND GXYGEN-SYSTEMS APCI-DES-ENG-STD-546.1 APCI-IIFI-4 1P 2/21/72 APCI-IIF3-4 15P 1/23/72 APCI-MEMO-68 12/30/68 2P PLUS 2P ATTACHMENTS APCI-MEMO-71 01/19/71 2P PUMP-TYPE-GB114-SERIAL-NO-79 APL-SAFETY-DEPT-REP-26 APCI-MEMU-60 06/9/50 2P APCI PLASITE PROTECTIVE COATING 990002650 R.H.H. APCI LOX TRANSFER PUMPS 990002760 DN.F.K. APCI NASH VACUUM PUMPS PUMPS FAILURES COMPRESSURS AND PUMPS 990003890 MERS STEEL MURKS/SHOTTON 9900C5550 HAUL PROCEDUKES FOR LIQUID 990003710 APL CENTRIFUGAL CRYOGENIC 990005700 069700066 9900C3070

99000100 IFF THOSE CYLINDERS BEFURE REFILLING ANSI-831.3 104P 1966
990003470 ICAL ENGINEERS PETROLEUM REFINERY PIPING ANSI-831.3 104P 1966
990003480 OF NECHANICAL ENGINEERS REFRIGERATION PIPING CARSI-831.5 60P 1966
990003480 OF NECHANICAL ENGINEERS REFRIGERATION PIPING CARD 427P 1965
990003480 OF RESSURE AND PIPING BUELIEF UNDERSONATION AND PIPING CANDERS FOR COMPRESSED GASES CGA-PAMPHLET-S-990001340 RESSURE AND PIPING BUELIEF VALVES APCI-0ES-ENG-ST0-537.9 4P 7/65
99000240 AL REQUIREMENTS SAFETY AND RELIEF VALVES LOCATION AND PIPING-DESIGN CONSIDERATIONS APCI-PING-SPEC-J.18 4P 6/18/69
990003400 APCI CODED VESSEL REPAIRS APCI-POM-SEC-6.09 4P 15P OF ATTCHMIS SEE 205 205 207
990002280 APCI CODED VESSEL REPAIRS APCI-POM-SEC-6.09 4P 15P OF ATTCHMIS 11/29/68
990000370 PLOSION TESTING-POLYESTER RESIN IMPREGNATED FIBERGLASS LAVA APCI-MAR-67-0-8821 IP 3/62
990000370 TE BUNDEU WITH A PHENDLIC RESIN* CUTTING-CILS, HEXADECANE, HYDROCARBON TYPE CUTTING-CILS, KNOWN AS TYPE-GROUP 990005650 ELINE-TRANSPORTATION ROAD, RAILROAD, BARGE AND PIPELINE TRANSPORTATION VEHICLE ACCIDENT PROCEDURES APCI-II 990005650 ELINE-TRANSPORTATION ROAD, RAILROAD, BARGE AND PIPELINE TRANSPORTATION VIBRATION AND CONTROLLED SLOSHING 990005640 ELINE TRANSPORTATION WIRALLAND CONTROLLED SLOSHING 990005640 ELINE TRANSPORTATION ROAD, RAILROAD, BARGE AND PIPELINE TRANSPORTATION OXYGEN-DISPERSAL FROM VENTS AND LINE 990005640 YURETHANE-FCAM-INSULATION, RAYBESTOS-MANHATTAN-PACKING, AND IMPREGNATED ASSESTUS-KUPE MATERIAL APCI-MAR-87-99000520 ELINE TRANSLATION, RAYBESTOS-MANHATTAN-PACKING AND GASEDUS OXYGEN AD297124 DMIC-MEMO-163 990005260 FLAM. FLAL DXYGEN PLAIN REBGILER EXPLOSION AIGHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS W-990002370 GENERAL SPECIFICATION FOR RECIPROCATING CUMPRESSORS APCI-DES-ENG-STO-551.1.9.1 14P 2/3/71 99000250 CHINERY-FIELD TESTING AND RECIPROCATING OXYGEN COMPRESSORS APCI-DES-ENG-STO-551.1.9.1 14P 2/3/71 99000250 TRUCTIONS FOR AIR-PRODUCTS RED-SARS-PIPE APCI-DES-ENG-STO-572.1 SP 5/62 99000250 TRUCTIONS FOR AIR-PRODUCTS RED-INSTAND-MAND-THREADED-ENDS-RED BRASS-PIPE ASTM-B43 APCI-LARA-06 IP 2/21/72 990000100 IFF THOSE CYLINDERS BEFORE REFILLING AND CUTTING OXYGEN-03 12P 3/21/63 PLICES CYLINDERS BEFORE REFILLING AND LOAD AND 1960 AND 1960 AND 1000 A GUALIFICATION STANDARD FOR WELDING AND BRAZING PROCEDURES, WELDERS, BRAZERS, AND 990002110 OF MECHANICAL ENGINEERS

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990003020 1 TO DISCUSS LIQUID-CXYLEN
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                990002150 N OF FRACTURE-MECHANICS TO
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           990001370 NE-RUBBER GASKET COMPOUND-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        990005620 L-HAZARDS- CXYGEN-TRANSFER 990003990 INATION OF STATIC-TANK AND
                990005940 LIQUID AND
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                                                                                                                                                               SAFETY PANEL CRYOGENICS
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                                               COMPRESSED
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                                                                                                                                                                                                                                          PRODUCT VAPUR HAZAROS-
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                                                                                                                          APCI
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             GASEDUS
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                                               GAS
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      OXYGEN
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SAFE HANDLING OF CRYOGENIC LIQUIDS AND ASSOCIATED EQUIPMENT APCI-POM-SEC-1.17
SAFE HANDLING OF REGULATORS AND TORCHES APCI-PAPER 17P PLUS 2P ATTACHMENTS
SAFE-LIFE DESIGN IN CRYOGENIC PRESSURE-VESSELS ESSO-REPORT-NO-EE.26ER.70 17P
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ROAD RAILROAD BARGE AND PIPELINE-TRANSPORTATION CONTAMINATION-CONTROL APCI-IIF
ROAD RAILROAD BARGE AND PIPELINE-TRANSPORTATION ROAD, PAILROAD, BARGE AND PIPELI
ROAD RAILROAD BARGE AND PIPELINE-TRANSPORTATION ROAD, PAILROAD, BARGE AND PIPELI
ROAD RAILROAD BARGE AND PIPELINE TRANSPORTATION ROAD, RAILROAD, BARGE AND PIPELI
ROAD RAILROAD BARGE AND PIPELINE TRANSPORTATION RESSURE-PELIEF APCI-IIF2A-I
ROAD-VEHICLE-ASSEMBLIES FOR OXYGEN SERVICE APL-QCP-QIO REV.O 2P
ROAD, RAILROAD, BARGE AND PIPELINE TRANSPORTATION VEHICLE ACCIDENT PROCEDURES
ROAD, RAILROAD, BARGE AND PIPELINE TRANSPORTATION VIBRATION AND CONTROLLED SLOSH
ROAD, RAILROAD, BARGE AND PIPELINE TRANSPORTATION OXYGEN-DISPERSAL FROM VENTS AND
ROCK WOOL APCI-MEND 2 HIMMELBERGER, F. APCI QUALITY CONTROL OF ROCK WOOL
ROCK WOOL APCI-MEND 2 HIMMELBERGER, APCI QUALITY CONTROL OF ROCK WOOL
ROCK WOOL BETHLEHER-STEEL-CO APCI-MEMO-59 11/6/59 2P
ROCK WOOL BETHLEHER-STEEL-CO APCI-MEMO-59 11/12/59 2P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SAFETY EQUIPMENT NEVER PREVENTS AN ACCIDENT- IT ONLY PREVENTS AN INJURY APOSAFETY GLASSES SAVE ANOTHER PAIR OF EYES APCI-SAFETY-GRAM-NO-OI IP 6/1/61 SAFETY IN AIR AND AMMONIA PLANTS AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND A SAFETY IN WELDING AND CUTTING USAS-249. 1 49P 1967
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          KOGERSTÜNE/NEWPORT 5/18/71 APL-SAFETY-DEPT-REP-37 7P 6/2/71
ROGNAC PLANT 3/2/71 APL-SAFETY-BULL-107 3P 4/14/71
RTV-60-NP-134372-M235 APCI-R+U-NOTEBOUK-111 P149 1P 1/63
RTV-60, SILICUME-RUBBER COMPOUND WITH SS-4004-SILICONE-PKIMER GE THERMOLITE-12-CURI RUBBER-HUSES PLASITE-NU-7122H APCI-MAR-87-0-8820 1P 6/60
                                            SAFETY
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                                                                                                                                                                                                                                                                                                                     SAFETY
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RUPTURE DISCS MANUFACTURED LOX TANKERS BY AMETEK APCI-MEMO-71 06/22/71 IP
RUPTURE-DISCS APCI-POM-SEC-6.02 IPP INCLUDING EXHIBITS ABCDE 12/8/64
                                                                                                                                                                                                                                                                               SAFETY
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         INSTRUCTION FOR REGULATURS AND COMPRESSED GASES
                                                                                                                                                                                                                                                              CONTROL PROCEDURES TAG OUT APCI-POM-SEC-1.G3 ZP PLUS EXHIBIT-A IP CONTROL PROCEDURES EMERGENCY PROCEDURES APCI-SAFETY-STO-626.3.8 8P CONTROL PROCEDURES TAG OUT PROCEDURE APCI-SAFETY-STO-626.3.3 ZP 5/ CONTROL PROCEDURES-PORGING METHODS APCI-SAFETY-STO-626.4.1 7P 1/70 CONTROL PROCEDURES- AIR-SEPARATION-PLANT SAFETY WORK PERMITS APCI-SECURATION APCI-S
REGULATIONS 3P 9/13/71 PLUS NOTES ON VISIT TO HMS ARK-ROYAL ON 11/8/71 RELIEF DEVICE STANDARDS PT-3 COMPRESSED-GAS STORAGE-CONTAINERS CGA-PAIREVIEW DATA- ACCIDENT/INCIDENT INVESTIGATION AND REPORT-APCI COCUMENTS LI
                                                                                                                                                                                                                                                                                                                                                                                                                              CONTROL PROCEDURE- SAFETY WORK-PERMIT APCI-POM-SEC-1.04
CONTROL PROCEDURE- TAG OUT APCI-POM-SEC-1.63 2P PLUS
                                                                                                                      POLICY
                                                                                                                                                            MANUAL P122
                                                                                                                                                                                          INFURMATION RELATIVE TO LIQUID-VAPUR-CLOUDS MANUAL APCI-SAFETY MANUAL-20P64 88P 196
                                                                                                                                                                                                 MANUAL
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APCI-MEMO-71 2/19/71 1P
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                                                                                                                APCI-POM-SEC-5.16 72 10/30/68
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APCI-DES-ENG-STD-537.1 6P 4/21/59

APCI-MEMO-61 06/28/61 5P
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9900C2170 LATSHAW.D.R. APCI UXYGEN SAFETY REVIEW CHECK-LIST APCI-MEMO-71 05/4/71 3P
990004050 GRAM, J. H. APL DESIGN AND SAFETY SATNDAPDS FOR CARBON-STEEL GASEDUS OXYGEN TRANSMISSION-LINES APL-ENGR-S
990005850
           APCI SYSTEM-EMERGENCIES SAFETY TRAINING AND AREA PLACARDING APCI-IVA-1 4P 11/5/71
990002050 URES- AIR-SEPARATION-PLANT SAFETY WORK PERMITS APCI-SAFETY-STD-626.3.5 3P 6/19/61
990003020 AL ON 11/8/71 TO DISCUSS SAFETY OF SHIPBOARD LOX-PLANTS 2P 9/13/71
990001960
            COMPRESSED GAS ASSUC SAFETY RELIEF DEVICE STANDARDS PART-1- CYLINDERS FÜR COMPRESSED GASES CGA-PAMP
990003460
                             APCI SAFETY RELIEF VALVES LUCATION AND PIPING-DESIGN CONSIDERATIONS APCI PIPING GROU
                              APCI SAFETY REPORTS AND FORMS APCI-POM-SEC-5.18 6P PLUS EXHIBITS ABCDEFGH 3/3/70
990002330
                         APCI WEAR SAFETY SHOES APCI-SAFETY-GRAM-NO-11 2P 5/14/62
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                   BROPHY, M. APCI SAFETY TESTS UNDER WO-81-0095 HYLDMAR-UNIVERSAL-JOINTING COMPOUND SG-32 AND VITUN
990001350
990001850 CI COLD TEST OF 1/2-INCH SAFETY VALVE WITH CARBON STEEL SPRING APCI-IWO-NO-10-7071 APCI-PROJECT-NO+00-5-
9900C2030 SAFETY CONTROL PROCEDURE- SAFETY WORK-PERMIT APCI-POM-SEC-1.04 3P PLUS EXHIBIT-A 1P 2/16/67
                        APCI FLEET SAFETY- FIRE EXTINGUISHMENT APCI-SAFETY-STD-635.30 5P 2/68
990001970
990001940
                        AFCI FLEET SAFETY- LOADING AND UNLOADING OPERATIONS APCI-SAFETY-STD-635.19 6P 2/68
990003270 MPLER.R.D. APCI LOX-PUMP SAFETY-BARRIERS APCI-MEMO-71 02/19/71 2P
             BALL, No.L. APCI ARE SAFETY-GLASSES WORTH THE COST AND EFFORT APCI-SAFETY-GRAM-NO-30 1P 8/9/63
9900C2410 ALL, W.L. APCI INDUSTRIAL SAFETY-INDUSTRIAL SAFETY PULICY APCI-SAFETY-STD-625.0.1 13P 10/3/61
990000460 PLANT, PIPING, VALVES AND SAFETY-RELIEF DEVICES APCI-SAFETY-STD-607.1.12 14P 10/62
9900C3510 PIPELINE- MINIMUM FEDERAL SAFETY-STANDARDS ESTABLISHMENT OF MINIMUM STANDARDS FEDERAL REGISTER VOL-35
990003570 PIPELINE- MINIMUM FEDERAL SAFETY-STANDARDS EXTENSION OF TIME FOR CONFIRMATION OF REVISION OF MAXIMUM ALLOWA
990003520 PIPELINE- MINIMUM FEDERAL SAFETY-STANDARDS FILING OF INSPECTION AND MAINTENANCE PLANS FEDERAL REGISTER V
990003550 E SAFETY MINIMUM FEDERAL SAFETY-STANDARDS FOR GAS PIPELINES CORROSION-PITTING- NOTICE OF PUBLIC HEARING F
990003540 PIPELINE- MINIMUM FEDERAL SAFETY-STANDARDS MISC AMENDMENTS FEDERAL REGISTER V-35 N-223 11/17/70
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990003560 PIPELINE- MINIMUM FEDERAL SAFETY-STANDARDS REQUIREMENTS FOR CORROSION CONTROL FEDERAL REGISTER VOL-36 N
990001210
                 MCYSAN, S.R. APCI SAFETY-VALVE-SEAT OXOMAT FLAMMABILITY IN 100-PERCENT GASEOUS DXYGEN APCI-ANAL-R
                             APCI SAFETY-VALVES AND RUPTURE-DISCS APCI-POM-SEC-6.02 19P INCLUDING EXHIBITS ABCDE
990002300
990000660
                 FOSTER, R. H. APCI SAFETY, HAZAROS, AND EXPLOSION TESTING- IGNITION TEST-APPARATUS, FLORUBE-GREASES, E
990000640
                  KEMAT, E. APCL SAFETY, HAZARDS, AND EXPLOSION TESTING- CS2 CARBON-DISULFIDE ALIQUIPPA PUMP-SUCTION
990000590
                 FOSTER, R. H. APCI SAFETY, HAZAROS, AND EXPLOSION TESTING-HOUDRY FOAM INSULATION. AND HAVEG GLASS-FIB
990000630
                   KEHAT, E. APCI SAFETY, HAZARDS, AND EXPLOSION TESTING- SILICON-OILS DOW-CORNING-RF-1-0065, SILICON
990000650 HAT, E. FOSTER, R.H. APCI SAFETY, HAZARDS, AND EXPLOSION TESTING-STANDARD IGNITION TEST METHOD, APL PIPING-R
990000520
                   KEHAT, E. APCI SAFETY, HAZARDS, AND EXPLOSION TESTING- PINE AND MAPLE WOOD, ACTIVATED CARBON APC
                 🕆 KEHAT, E. ÀPCI SAFETY, HAZARDS, AND EXPLOSION TESTING- SPARK-IGNITION, STANDARD BOMB TEST, LED-PLA
990000610
990006670
                 FOSTER & R. H. APCI SAFETY, HAZARDS, AND EXPLOSION TESTING- POLYESTER RESIN IMPREGNATED FIRERGLASS FAV
990000680
                 FOSTER, K. H. APCI SAFETY, HAZAROS, AND EXPLOSION TESTING- EPON-H-60, POLYCEL-440R. AND STYROFOAM. LUB
990000590
                    KEHAT, E. APCI SAFETY, HAZARDS, AND EXPLOSION TESTING- UCON-TYPE LUBRICANTS, STEEL-PIPES APCI-MA
990000000
                    KEHAT, E. APCI SAFETY, HAZARDS, AND EXPLOSION TESTING- STANDARD PRESSURE BOMBS AND SPARK-IGNITION.
990000700
                 FOSTER, R. H. APCI SAFETY, HAZAKOS, AND EXPLOSION TESTING- TALCUM-POWDER AS A LUBRICANT, TARSET, PLASI
990000970 NT CUNTAMINATIUN- HISTORY, SAMPLING, AND ANALYSIS APCI PLANT MANAGERS SAFETY MEETING-CREIGHTON/PENNSYLVA
990001150 ESCENCE DAMCO-TEFLON TAPE, SANDEM-INDUSTRIAL, CRANE PACKING CO. APCI-ANAL-REP-70-368,70-369 1P 10/7/70
990004540 S AND THREADING COMPOUNDS- SANDEN TAPE APC1-1424-08 2P 2/21/72
990000900 NING LOX STORAGE TANK-NO-6 SANTA/SUSANA APCI-MEMD-64 03/11/64 IP PLUS IP ATTACHMENT
            APCI LOX TRANSFER PUMP SCREENS APCI-MEMO-69 01/24/69 2P PLUS 3P ATTACHMENTS
990002660
990002910 LAPIN, A. APCI TESTING OF SCREENS TO BE USED IN UXYGEN COMPRESSOR SUCTION APCI-MEMO-71 07/26/71 2P
990001190 w. APCL REGULATOR THREAD SEALANT MOLYLUBE-N APCI-MEMO-63 10/4/63 IP
990001220 BROPHY, M.+ APCI PERMATEX SEALANT-1516- COMPATABILITY TESTS WITH HIGH-PRESSURE DXYGEN APCI-R+D-NCTEBOUK-111
990001180 PING- APPROVED PIPE THREAD SEALANTS APCI-DES-ENG-STD-570.5.1 IP 11/11/60
                             APCI SEALANTS AND THREADING COMPOUNDS- PERMATEX-1516 APCI-1A2A-01 1P 2/21/72
990004470
990004520
                             APCI SEALANTS AND THREADING COMPOUNDS- CROSSLITE-FLUOROCARBON-TAPE APCI-1A2A-06 2P 2
                             APCI SEALANTS AND THREADING COMPOUNDS- THREE-M FLUCKOCARBON-TAPE APCI-[A2A-11 2F 2/2
990004570
                           - APCI SEALANTS AND THREADING COMPOUNDS- CRANE PACKING CO-TAPE APCI-1A2A-09 2P 2/21/
990004550
                          APCI SEALANTS AND THREADING COMPOUNDS- PUTTI-ROPE NATIONAL DREENHOUSE CO APCI-1424-0
990004500
                            APCI SEALANTS AND THREADING COMPOUNDS- T-FILM ECO MEGR CO APCI-1A2A-03 1P 2/21/72
990004490
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PROCEEDINGS

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APCI SEALANTS AND THREADING COMPOUNDS- TEFLON-TAPE PERMACEL APCI-IA2A-02 2P 2/21/72
APCI SEALANTS AND THREADING COMPOUNDS- SANDEN TAPE APCI-IA2A-08 2P 2/21/72
APCI SEALANTS AND THREADING COMPOUNDS- MOLYLUBE-N BEL-RAY CO FARMINGDALE/NJ APCI-IA2
APCI SEALANTS AND THREADING COMPOUNDS- MOCHING-IA2A-10 IP 2/21/72
APCI SEALANTS AND THREADING COMPOUNDS- SODIUM-SILICATE AND CHINA-CLAY-PASTE APCI-IA2A-SEAL THREAD LUBRICANT AND SEALER- TAPE-SEAL FROM FRIESLAND-PLASTIC COMPANY, PEFMACEL-TAPE APCI-IANA-REP-60
S, AND SURFACE TREATMENTS- SEALFAS-MASTIC-31-97. BENJAMIN FOSTER CO APCI-IA6A-02 IP 2/21/72
ALFAS-MASTIC-31-97-LIQUID, SEALFAS-MASTIC-31-97-DRY, PITTSEAL-III-LIQUID, PURGUS-INSULATING-MATERIAL FOAM GLAS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         ** ACCULTANCE SEARS THREAD-CUTING-OIL APCI-ANAL-REP IP 7/15/71

** VERSILUBE-F-50, SFB1(40)-SILICONE, PVORAUL-F-9, DOW-CORNING-4 COMPOUND SILICONE, DOW-CORNING-4X COMPOUND SILICONE, DOW-CORNING-4X COMPOUND SILICONE, DOW-CORNING-4X COMPOUND SILICONE, DOW-CORNING-4X COMPOUND SILICONE APCI-MEMO-68 06/12/68 2P

** VERSILUBE-F-50, SFB1(40)-SILICONE, PVORAUL-F-9, DOW-CORNING-4 COMPOUND SILICONE, DOW-CORNING-4X COMPOUND SILICONE, DOW-COMPOUND SILICONE, DOW-CORNING-4X COMPOUND SILICONE, DOW-COMPOUND SILICONE, DOW-CORNING-4X COMPOUND SILICONE, DOW-COMPOUND SILICONE, DOW-COMPOUND SILICONE, DOW-COMPOUND SILICONE, DOW-COMPOUND SILICONE, DOW-COMPOUND SILICONE, DOW-COMPOUND SILICONE, DOW-COM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              990000640 UN-FILTER-DEFROST CYL-SEAL SEALING COMPUUND APCI-MAR-87-0-8821 IP 12761
990001300 YUDER,L. APCI SEALING MATERIALS- FLAMMABILITY IN 100-PERCENT GASEOUS UXYGEN FUAMSEAL-30-45-LIQ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SHELL AND TUBE-TYPE-COULERS FOR OXYGEN SERVICE APL-ENGR-SPEC-E.05 13P 6/1/71
SHELL AND TUBE-TYPE-COULER, OTHER THAN FOR OXYGEN SERVICE (APL-PLANTS) APL-ENGR-SHELL AND TUBE-TYPE-COULER, OTHER THAN FOR OXYGEN SERVICE (APL-PLANTS) APL-ENGR-SHELL-2-1176-A-HYDRGCARBON, INDOIL CHEMICAL INDUPOL-I-10-POLYBUTENE, INDOPOL-H-300-SHELL-DESIGN APCI-DES-ENG-SID-510.2 4P 2/65
SHELL-DESIGN APCI-DES-ENG-SID-510.2 4P 2/65
SHERLOCK-LEAK DETECTOR-WITH-15-PERCENT-METHANDL, SCDIUM-NITRITE-SOLUTION INHIBITOR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SHERLOCK-LEAK-DETECTOR-TYPE-DG, SHERLOCK-LEAK DETECTOK-WITH-15-PERCENT-METHANOL, SO SHERWIN-WILLIAMS-E41A4, SUPERFLAKE-1822, SUPERIOR-GRAPHITE-CG, CALQUARTZ-SGOIUM SIL SHIELDS AND OXYGEN-SYSTEMS APCI-DES-ENG-STD-546.1 SP 1/15/11 SHIELDS FUR UXYGEN SYSTEMS APCI-DES-ENG-STD-546.1 SP 1/15/11 APPLICABLE TO APCI-DES-ENG-SHIBBUARD LOX-PLANTS 2P 9/13/71 APPLICABLE TO APCI-DES-ENG-SHUCK (THERMAL AND PRESSURE), LINE-SUNGES APCI-11F38-1 IP 2/18/72 SHUES APCI-SAFETY-GRAM-NU-11 2P 5/14/62
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             SILICATE, 3M-DC1252-MARKER-PUTTY, GURABLE-MANUFACTURING COMPANY-GASKET MATERIAL, JO
SILICONE-O-RING (1/8-INCH DIA) APCI-IWU-NO-XD-O128 APCI-ANAL-REP-71-399 IP
SILICONE-RUBBER COMPOUND WITH SS-4004-SILICONE-PRIMER GE THERMOLITE-12-CURING-CATAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    990001400 -9, DGW-CURNING-4 CGMPGUND SILICONE, DGW-CORNING-4X COMPGUND-SILICONE, FAIRBANKS-SILICONE-DC-44, MORSE GREASE, 990000630 DS, AND EXPLOSION TESTING- SILICON-GILS DGW-CORNING-RF-1-0065, SILICON-GILS DGW-CORNING-RF-1-0065, SILICON-GILS DGW-CORNING-RF-1-0065, SILICON-GILS DGW-CORNING-RF-1-0065, SILICON-GILS DGW-CORNING-RF-1-0065, SILICON-GILS, SHELL POLYURETHANE FOAM (EPGN-FUAM-H-60) APCI-MAR-87-0-8820 IP 8/990005210 S, AND SURFACE IREAIMENIS- SILVER APCI-IA6A-35 IP Z/ZL/7Z
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 990004849 PCI GASKETS AND PACKINGS- SINDANYO CS-51—ASBESTOS AND CEMENT BOARDS. NATUKAL-UNTREATED-FINISH TURNERS 990004840 PCI GASKETS APCI CAUTION- SMIFF TESTING CYLINDERS HAS ITS HAZARDS APCI-SAFETY-GRAM-NG-49 2P 3/26/65 990000100 SCHMOYER; W. W. APCI SKIFF THUSE CYLINDERS BEFORE REFILLING APCI-SAFETY-GRAM-NG-31 2P 8/21/63 990002820 U EXISTING PRESSURE-GAUGES SNUBBER APCI-DES-ENG-STD-531.10.2 2P 12/5/61 9900C1890 -with-15-PERCENT-METHÄNDL, SGÜLUM-NITRITE-SGLUTION INHIBITUR CRYUSENIC ENGINEERING CONFERENCE PROCEE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    990001300
100YGEN FLOW-MEIER RING SEAL-FLUID APCI-MEMU-70 02/27/70 1P
990001110 INYLCHLORIDE, PLASTIC LEAD SEAL-NO-2-JOHN CRANE APCI-MEMU-59 01/28/59 2P
990001110 UCTS INC, ALUMINUM-DXIDE, SEAM COMPOUND GEON POLYVINYLCHLORIDE, PLASTIC LEAD SEAL-NO-2-JOHN CRANE
990001110 UCTS INC, ALUMINUM-DXIDE, SEAM COMPOUND GEON POLYVINYLCHLORIDE, PLASTIC LEAD SEAL-NO-2-JOHN CRANE
990001110 UCTS INC, ALUMINUM-DXIDE, SEAM COMPOUND GEON POLYVINYLCHLORIDE, PLASTIC LEAD SEAL-NO-2-JOHN CRANE
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SILICGNE-RUBBER GASKET COMPOUND- RTV-60-NP-134372-M235
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SHPEROIDAL-GRAPHITE IRUN CONTINENTAL-STANDARD-GGG-38
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    990001400 KEL-F-LF3, VERSILUBE-F-50,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ST GAUGE EQUIPMENT FAILURE
PLUSION AND TANKER FIRE AT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  FLUORINATED SILICON-GILS,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          HAVOL INE-HD-HYDROCARBUN,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            OCK-LEAK-DETECTOR-TYPE-DG,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   990005730 ING, EXCESSIVE VIBRATIONS, 990003210 APCI MEAR SAFETY
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         990063060 PCI CXYGEN INDEX RATING
990004660 RS, AND ADHESIVES- KIV-60,
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 990003280 APCI PERSONNEL-PROTECTIVE 990003020 8/71 TO 0ISCUSS SAFETY OF
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     990001370 N COMPATABILITY TESTS WITH
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AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AS12—TP304 AND ASTM—AS12—TP304 AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AS12—TP304 AND ASTM—AS12—TP304 AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AS12—TP304 AND ASTM—AS12—TP304 AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AS12—TP304 AND ASTM—AS30 Z AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AS30—GR—GRA—30 Z AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AS03—WP304 AND AG03—WP304L AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AS03—BP304 AND AG03—WP304L AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AS03—304 APCI—IA6A—20 Z P Z/Z AND SURFACE TREATMENTS—ALPHA BWASS—TYPE TCL—100 OR DTD—5019 TUNGUM CO L AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—AS040—304 APCI—IA6A—20 Z P Z/Z I/7Z AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—A240—304 APCI—IA6A—20 Z P Z/Z I/7Z AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—A240—304 APCI—IA6A—20 Z Z/Z I/7Z AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—A240—304 APCI—IA6A—21 Z P Z/Z I/7Z AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—A240—304 APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—A240—304 APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—STAINLESS STEEL ASTM—A240—304 APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—STAINLESS STEEL ALLCY TO DIN GFRMAN NATI AND SURFACE TREATMENTS—STAINLESS STEEL ALLCY TO DIN GFRMAN NATI AND SURFACE TREATMENTS—STAINLESS STEEL ALLCY TO DIN GFRMAN NATI AND SURFACE TREATMENTS—COPPER—TUNE ASTM—BAS APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—COPPER—TUNE ASTM—BAS APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—COPPER—TUNE ASTM—BAS APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—COPPER—TUNE ASTM—BAS APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—COPPER—TUNE ASTM—BAS APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—COPPER—TUNE ASTM—BAS APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—COPPER—TUNE ASTM—BAS APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—COPPER—TUNE ASTM—BAS APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—COPPER—TUNE ASTM—BAS APCI—IA6A—27 Z P Z/Z I/7Z AND SURFACE TREATMENTS—COPP
                                                                                                                   TREATMENTS- COPPER-TUBE ASTM-BTS APCI-IA6A-05 IP 2/21/72
TREATMENTS- COPPER-PIPE ASTM-B42 APCI-IA6A-04 IP 2/21/72
TREATMENTS- ALUMINUM ASTM-B247-6061-T6 APCI-IA6A-12 2P 2/2
TREATMENTS- PLASITE-NU-7122H WISCONSIN PROTECTIVE COATING C
                                                                                                                                                                                                       TREATMENTS- CARBON STEEL (DXYGEN SERVICE) APCI-1A6A-19 2P 2/21 TREATMENTS- CARBON STEEL (DXYGEN SERVICE) APCI-1A6A-14 3P TREATMENTS- KEALGASCHASTIC 11 77
                                                                                                                                                                                                                                                                        TREATMENTS- ALUMINUM ASTM-B241-6061-To APCI-IA6A-11 2P 2/2
TREATMENTS- RED-BRASS-PIPE ASTM-B43 APCI-IA6A-06 IP 2/21/7
TREATMENTS- CARBON STEEL- NON-DXYGEN SERVICE WITH POSSIBLE EX
                                                                                                                                                                                                                                                                                                                                                                                                     -PER
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                                                           TREATMENTS- ALUMINUM B361-WP6061-16 APCI-IA6A-13 2P 2/21/7
                                                                                                  TREATMENTS- ALUMINUM, ASTM-B-210-3003 APCI-IA6A-08 2P 2/21
                                                                                                                                                                                                                                                                                                                                                                              APCI-IA6A-18 2P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      APCI-ANAL-REP-70-013,70-014,
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                                                                                                                                                                                                                                                     APC I-
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                                                                                APC 1-1 A6 A-01
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                                                                                                                                                                                                                                                TREATMENTS- SEALFAS-MASTIC-31-97 BENJAMIN FOSTER CO
                  TREATMENTS- ALUMINUM ASTM-B211-2024-T4 APCI-1A6A-07 TREATMENTS- ALUMINUM ASTM-5210-6061-T6 APCI-1A6A-10
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MISC- 1,1,1 TRICHLORDETHANE APCI-1A7A-02 1P 2/2
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                                                                                TREATMENTS- TARSET PITTSBURGH CHEMICAL CO
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2/21/72
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APCI-POM-SEC-1.05 12P 2/20/67
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SOLVENTS, AND MISC- CARBON-TETRACHLURIDE APCI-1A7A-04 15
SOLVENTS, AND MISC- CHLOROFORM APCI-IATA-03 1P 2/21/72
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MISC- TRICHLORDETHYLENE APCI-IA7A-05 IP
APCI-IA2A-12 IP
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SCXHLET ETHER-EXTRACTION MELRATH GARLUCK-900 APCI-A
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SUDJUM-SILICATE AND CHINA-CLAY-PASTE
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990001350 NIVERSAL-JOINTING COMPOUND SQ-32 AND VITON A APCI-IND-NO-81-0095 IP 4/27/66
990001350 NIVERSAL-JOINTING COMPOUND SQ-32 AND VITON A APCI-IND-NO-81-0095 IP 4/27/66
990003840 USTAG-GBILLE LUX-PUMP ON AN SSPC LUX-TANKER APL-SAFETY-DEPT-REP-32 99 7/10/70
990003860 USYGEN CCMPRESSOR FIRE AI SSPC LUX-TANKER APL-SAFETY-BULL-107 3P 4/14/71
990003860 USYGEN CCMPRESSOR FIRE AI SSPC KGGNG PLANT 3/2/71. APL-SAFETY-BULL-107 3P 4/14/71
990003860 USYGEN CCMPRESSOR FIRE AI SSPC KGGNG PLANT SAPL-SAFETY-BULL-107 3P 4/14/71
990003860 USYGEN FIRE AI SSPC KGGNG PLANT SAPL-SAFETY-BULL-107 3P 4/14/71
990003860 USYGEN FIRE AI SSPC KGGNG PLANT SAPL-SAFETY-BULL-107 3P 4/14/71
990003870 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A18-4-87321 APCI-IAGA-31 2P 2/21/72
990005070 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A19-4-87321 APCI-IAGA-19 2P 2/21/72
990005070 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A269-304 APCI-IAGA-19 2P 2/21/72
990005070 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A312-TP304 APCI-IAGA-19 2P 2/21/72
990005010 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A312-TP304 APCI-IAGA-19 2P 2/21/72
990005010 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A312-TP304 APCI-IAGA-19 2P 2/21/72
990005010 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A312-TP304 APCI-IAGA-19 2P 2/21/72
990005010 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A312-TP304 APCI-IAGA-19 2P 2/21/72
990005010 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A312-TP304 APCI-IAGA-19 2P 2/21/72
990005200 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A312-TP304 APCI-IAGA-19 CP 2/21/72
990005200 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A32-D-304 AND A903-MAD SURFACE TREATMENTS- STAINLESS STEEL ASTM-A330-D-304 APCI-IAGA-19 CP 2/21/72
990005200 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A32-D-304 APCI-IAGA-19 CP 2/21/72
990005200 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A32-D-304 APCI-IAGA-19 CP 2/21/72
990005200 S. AND SURFACE TREATMENTS- STAINLESS STEEL ASTM-A32-D-304 APCI-A34-19 CP 2/21/72
990005200 S. AND
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      SPILLS AND LEAKAGE DRAINAGE AND ULTIMATE DISPOSAL ARRANGEMENTS APCI-IIDI-1 2P SPILLS AND LEAKAGE ENVIRONMENTAL WARNINGS AND ESCAPE SYSTEMS APCI-IIO3-1 1P 8 SPILLS AND LEAKAGE SEPARATION OF INCOMPATIBLE MATERIALS AND IGNITION SCURCES IN DISSPINTEX-305, MOLYROTE-TYPE-2 AND TYPE-X-15 APCI-MAR-87-0-8822 1P 3763
                                                                                                                                                                                                                                                                                                                                                                 APC1-JOB SPECIFICAT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   APC 1-1104-1 1P
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 STANDARD IGNITION TEST - APCI-PROJECT-NO-87-0-8420/1 8P 11/17/61
STANDARD IGNITION TEST METHYLENE-CHLORIDE- DICHLORDETHANE- TRICHLORDETHANE- TRICHLO
                                     SPECIFICATION FOR CENTRIFUGAL COMPRESSORS
SPECIFICATION FOR CENTRIFUGAL COMPRESSORS
SPECIFICATION FOR CLEANING FOR UXYGEN SERVICE
SPECIFICATION FOR OXYGEN SERVICE
SPECIFICATION FOR OXYGEN SERVICE VESSEL FABRICATION
SPECIFICATION FOR OXYGEN SERVICE PRESSORE-VESSEL FABRICATION
SPECIFICATION FOR DXYGEN SERVICE PRESSORE-VESSEL FABRICATION
SPECIFICATION FOR BECIPROCATING COMPRESSORS
SPECIFICATION FOR RECIPROCATING COMPRESSORS
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 APL-SAFETY-DEPI-INFO-SHEET-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            APCI-MAK-87-0-8820 1
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    APC 1-MAR-87-0-8820
                                                                                                                                                                                                                                                                                                                                                             SPECIFICATION 310000 GALLON CAPACITY LOX/LIN STORAGE TANK APCI-JOB SPECIFIC SPECIFICATIONS GENERAL CONSTRUCTION AND EQUIPMENT ERECTION GXYGEN COMPRESSION
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      APCI-PROJECT-NO-00-7-3480-51.00
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          APC1-MAR-87-0-8820 1P 9/61
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            2/21/72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SPILLS AND LEAKAGE DETECTION- QUANTITY AND RESPONSE TIME LIMITS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SPRING APCI-INO-NU-10-7071 APCI-PRUJECT-NU-00-5-3246-51.12.50
                                                                                                                                                                                                                                                                                                                                                                                                                                                                        APCI-QUAL-CONT-LAYOUT-120F 3P 7/1/71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            990000010 N TESTING- SPARK-IGNITION, STANDARD BOMB TEST, LEO-PLATE-251, PIPE-DOPE APCI-KAR-87-0-8820
990002440 FIRE PREVENTION ASSUC STANDARD FOR THE INSTALLATION AND OPERATION OF OXYGEN-FUEL GAS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       STAINLESS-STEEL-HOUSING, AND KUBBER-HOSES PLASITE-NU-7122H
STANDARD BUMB TEST, LEU-PLATE-251, PIPE-DUPE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            APCI-1464-20 1P
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STAINLESS STEELS IN AN OXYGEN-ATMOSPHERE APCI-PROJEC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     STAINLESS-STEEL APCI-DES-ENG-STD-579.15 2P 9/66
STAINLESS-STEEL AND COPPER-PIPE FITTINGS PARTS AND FA
STAINLESS-STEEL SURFACES EXPOSED TO CASEGUS OXYGEN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           APCI-DES-ENG-STD-578.30.15
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    APC I-DES-ENG-STD-578,30,1
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SPECIFIED PAINT SYSTEMS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       DEVELUPMENT OF STANDARD IGNITION TEST DEVELOPMENT OF STANDARD IGNITION TEST ?
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STAINLESS STEEL-PIPE
STAINLESS STEEL-PIPE
STAINLESS STEEL-PIPE
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      SPILLS AND LEAKAGE
                                         990003410 KHILL,W.R. APCI STANDAKD
990003360 DEHMKE,G.R. APCI GENERAL
990003350 DEHMKE,G.R. APCI GENERAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           990000710 N-PRESSURE-GAUGE TWF WOOL, 990001850 TY VALVE WITH CARBON STEEL 990001350 NIVERSAL-JOINTING COMPOUND
                                                                                                                                                                                                                                                                                                                                                                 LL, k. R. APCI JOB
APCI CONSTRUCTION
                                                                                                                                                                                                                                                                                                                                                                                                                                                                        REQUIREMENTS FOR IPD
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           OPERATIONAL-HAZARUS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   OPERATIONAL-HAZAROS-
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I IGNITION-LIMITS OF SOME
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  S, AND SURFACE TREATMENTS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          990000370 ICh-JUINTS AND ALUMINUM TO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    APCI PIPING-
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                                                                                                                                                         GENERAL
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                                                                                                                                                                                                                                                                                                              GENERAL
                                                                                                                                                                                                   PEGRAM, J.W. APL
PEGRAM, J.W. APL
                                                                                                                                                                                                                                                                                                                                                                 KRILLING APCI
                                                                                                                                                                                                                                                                                                                   STULZ, J.L. APCI
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STANDARD PICTORIAL SURFACE PREPARATION STANDARDS FOR PAINTING STEEL SURFACES AS STANDARD PRESSURE BOMBS AND SPARK-IGNITION, DOW-CORNING FLUORINATED SILICON-OILS, S STANDARD SPECIFICATION FOR A FIELD-FABRICATED CRYDGENIC LIQUID STORAGE-TANK (FLAT-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    STEEL (UXYGEN SERVICE) APCI-IA6A-14 3P 2/21/72
STEEL PIPE AND FITTINGS, CLEANING ALUMINUM-PIPE FITTINGS PARTS AND FABPICATIONS,
STEEL PIPES IN A FLUMING OXYGEN STREAM APCI-MEMG-61 04/17/61 3P PLUS 7P ATTA
STEEL SPRING APCI-IMO-NO-10-7071 APCI-PROJECT-NG-00-5-3246-51.12.50 APCI-TM-0
STEEL-POW-OXYGEN SERVICE WITH PUSSIBLE EXPUSURE TO GXYGEN APCI-IA6A-33 3P 2/
STEEL-PIPE APCI-DES-ENG-STD-578.40.1 3P 9/62
STEEL-PIPE APCI-DES-ENG-STD-578.30.1 7P 5/62
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 APCI-IWU-NU-LB-0043 APCI-TM-112 6P 5/8/6 STANDARDS COMPUSITION 5-PERCENT-CR 17-PERC
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APL-ENGK-STD-LS.31/1 7P
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  STANDARD IGNITION TEST METHOD, APL PIPING-RESIDUE, METHYLENE-CHLORIDE
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                                                                                                                                             STATIC-TANK AND ROAD-VEHICLE-ASSEMBLIES FOR UXYGEN SERVICE STATIC-TANKS FUR UXYGEN SERVICE APL-QCP-Q12 REV.O IP STATIC-TANKS FOR UXYGEN SERVICE APL-QCP-013 REV.O IP
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14P 8/24/70
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                                                                                                                                                                                                                                                                     STEEL ASTM-A182-F-304 AND ASTM-A182-F-316 APCI-I
STEEL ASTM-A194-8F321 APCI-IA6A-19 2P 2/21/72
STEEL ASTM-A240-304 APCI-IA6A-16 2P 2/21/72
STEEL ASTM-A269-304 APCI-IA6A-26 2P 2/21/72
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2P 2/21/72
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275PSIG (CSU2.7)
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APCI-DES-ENG-STD-578.10.2 4P 10/69
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                                                                                                   STANDARUS APCI-DES-ENG-STD-510.1 6P 8/62
STANDARDS APCI-IIF2-1 2P 2/18/72
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STEEL-TYPE-304 UNIDENTIFIED AS TO ASTM-SPEC
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APC1-DES-ENG-STD-578,30.1
APC1-DES-ENG-STD-578,10.5
APC1-DES-ENG-STD-578,10.3
APC1-DES-ENG-STD-578,30.3
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S STEEL ASTM-A312-TP304 AP

S STEEL ASTM-A320-88304 AP

S STEEL ASTM-A351-GR-CF8 A

L STEEL ASTM-A353G8 APCI-I
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990005050 FACE TREATMENTS— STAINLESS
990005120 FACE TREATMENTS— STAINLESS
9900050120 FACE TREATMENTS— STAINLESS
990005040 HACE TREATMENTS— STAINLESS
990005160 FACE TREATMENTS— STAINLESS
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990001870 IGNITION—LIMITS OF CARBON
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        990001860 KEHAT,E. APCI BURMING OF
990001850 H SAFETY VALVE WITH CARBGN
990005190 SURFACE TREATMENTS— CARBON
990001820 OF 150-PSIG-MAX STAINLESS
990001740 O-THREADED-ENDS— STAINLESS
                                                                                                                                                                                                                                                         275-PSIG-MAX-UNG CARBON
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SURFACE TREATMENTS- CARBON APCI CLEANING OF CARBON
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990001700 F 72G-PSIG-MAX-UMG CARBON
DS, AND EXPLOSION TESTING-
                                                 OS, AND EXPLOSION TESTING-
                                                                            990003410 KRILL, W.R. APCI
99000018G L-DESIGN-BASIS AND GENERAL
                                                                                                                                                                             TANKERS AND
                                                                                                                                                                                                   990004026 KEL AND HI-FROOF STAINLESS
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                                                                                                                              TRANSPORTATION- LIST OF
                                                                                                                                                    URE FOR DECUNTAMINATION OF
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990005060 FACE TREATMENTS- STAINLESS
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SUPERFLAKE-1822, SUPERIOR-GRAPHITE-CO, CALQUARIZ-SUDIUM SILICATE, 3M-DC1252-MARKER-SUPERIOR-GRAPHITE-CO, CALQUARIZ-SUDIUM SILICATE, 3M-DC1252-MARKER-PUTTY, DURABLE-MA SUEFACE HEAT-EXCHANGERS APL-ENGR-SPEC-E, 02 9P 6/28/70
SURFACE HEAT-EXCHANGERS APL-ENGR-SPEC-E, 02 9P 6/28/70
SURFACE PREPARATION STANDARDS FOR PAINTING STEEL SURFACES ASTM-D2200-67 2P 19
SURFACE TREATMENTS- TARSET PITTSBURGH CHEMICAL CO APCI-1A6A-01 1P 2/21/72
SURFACE TREATMENTS- ALPHA BRASS-TYPE TCL-100 OR DTD-5019 TUNGUM CO LTD/UK COMPOSI
                                                                                                                                                                                                                     STORAGE, CONVERTER-SYSTEM, AND CRYDGENIC-LIQUIDS APCI-SAFETY-STD-607.2.1.1 3P 4 STORAGE, VACUUM-SYSTEMS, AND COMPRESSED-GASES APCI-SAFETY-STD-607.2.2.5 PI-4 3/
                                                                                                                                                                                                                                                                                                      APCI-1820-1 2P 10/28
                                                                                                                                                                                                                                                                                                                                                                                                          STRUCTURE APCI-IIIAL-1 1P 9/12/71
STRUCTURE OF CUTTING DILS TO THEIR DXYGEN-COMPATIBILITY AICHE-CEP-TECH-MANUAL SA
STYROFDAM AND POLYURETHANE-FOAM-INSULATION, RAYBESTOS-MANHATTAN-PACKING, AND IMPRE
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TREATMENTS- NOVONUX STAINLESS STEEL ALLOY TO DIN GERMAN NATIONAL STANDAR
                                                                                                                                                                           SYSTEM LOADING AND UNLUADI
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                                                                                                1P ATTACHMENT
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C0 APCI-IA6A-02
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19-5083-0 APCI-1A6A-09 2P 2/21/72

210-3003 APCI-1A6A-12 2P 2/21/72

210-3003 APCI-1A6A-10 2P 2/21/72

QC6061-T6 APCI-1A6A-10 2P 2/21/72

APCI-1A6A-25 2P 2/21/72

LATE ASTM-836 APCI-1A6A-28 2P 2/21/
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TREATMENTS- COPPER-TUBE ASTM-842 APCI-IA6A-04 IP 2/21/72
TREATMENTS- COPPER-PILICON ASTM-898GK8 APCI-IA6A-23 2P 2/21/72
TREATMENTS- FREE-MACHING BRASS APCI-IA6A-24 2P 2/21/72
TREATMENTS- MONEL ASTM-8164 APCI-IA6A-29 2P 2/21/72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       TREATMENTS - PLASITE-NO-7122H WISCONSIN PROTECTIVE COATING CO
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TREATMENTS—BRUNZE ASTM—861 OR 862 APCI—IA6A—27 2P 2/21/72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                TREATMENTS- ALUMINUM B361-WP6061-T6 APCI-1A6A-13 2P 2/21/72
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                                                                                            990000900 Y,A.L. APCI CLEANING LOX STORAGE TANK-NO-6 SANTA/SUSANA APCI-MEMU-64 03/11/64 IP PLUS 990005580 BKICATED CRYOGENIC LIQUID STORAGE TANKS APCI-11F1-3 IP 2/3/72 990005560 EK PRODUCTION TO STORAGE, STORAGE TO SYSTEM, STORAGE TO TRANSPORT, TRANSPORT TO SYSTEM 990005570 XYGEN-TRANSFOR PRODUCTION, STORAGE TO SYSTEM, STORAGE TO TRANSPORT, TRANSPORT TO SYSTEM L
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                      JC8-NO-00-2-2775
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TREATMENTS- ALUMINUM ASTM-B-210-6061-16 APCI-IA6A-10
TREATMENTS- BERYLLIUM CODDER
                                                                                                                                                                                                                                                                                9/2/11
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                                                                                                                                                                                                   18P 9/15/71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    STYROFDAM, LUBRICANTS, MOLY-SPRAY-KOTE, AND DRI-LUBE
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                                                                          APCI-MEMU-63 01/24/63
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  TANK APCI-JOB SPECIFICATION FOR TANKS API STANDARDS.
                                                                                                                                                                                                   APC 1-99820A
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                                                                     TANK CLEANING APCI-ME
TANK-NO-6 SANTA/SUSANA
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                        GALLON CAPACITY LOX/LIN
                                               ARGE, WELDED, LUM-PRESSURE
                                                                                                                                                                                                                                                                           990005370 LITY, COMPATIBILITY CHECK,
                                                                                                                                                                                                                                                                                                                                                                                                            990005750 SPECTION WHERE WHY AND HOW 990002010 LATIONSHIP OF THE CHEMICAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   990001890 R, SHERMIN-MILLIAMS-E41A4, 990001890 MS-E41A4, SUPERFLAKE-1822, 990003680 APL BRAZEG CORE EXTENDED
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                                                                                                                                                                                                                                 PLANT COMPONENTS-
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                                                                        MASTER, H. APCI
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SURFACE TREATMENTS—STAINLESS STEEL ASTM-A403-WP304 AND A403-WP304L APCI-IA6A-ITS SURFACE TREATMENTS—STAINLESS STEEL ASTM-A182-F-304 AND ASTM-A182-F-316 APCI-IA6A-20 SURFACE TREATMENTS—STAINLESS STEEL ASTM-A321-GR-CF8 APCI-IA6A-20 IP 2/SURFACE TREATMENTS—STAINLESS STEEL ASTM-A321-GR-CF8 APCI-IA6A-30 2P 2/21/72 SURFACE TREATMENTS—STAINLESS STEEL ASTM-A320-B3304 APCI-IA6A-20 2P 2/21/72 SURFACE TREATMENTS—STAINLESS STEEL ASTM-A320-B3304 APCI-IA6A-13 2P 2/21/72 SURFACE TREATMENTS—STAINLESS STEEL ASTM-A320-B3304 APCI-IA6A-19 2P 2/21/72 SURFACE TREATMENTS—STAINLESS STEEL ASTM-A320-B3304 APCI-IA6A-19 2P 2/21/72 SURGACE TREATMENTS—COPPER-TUBE ASTM-A88 APCI-IA6A-32 IP 2/21/72 SYSTEM-EMERGENCIES WARNING DEVICES APCI-IVB-1 5P 11/12/71
SYSTEMS- APL GXYGEN-TRANSFER METHODS TYPICAL INSTALLATIONS, AND OPERATIONS DEPART
SYSTEMS- FIELD FABRICATED CRYOGENIC LIQUID STURAGE TANKS APCI-IIFI-3 1P 2/3/7
SYSTEM, STORAGE TO TRANSPORT, TRANSPORT TO SYSTEM APCI-IIFI-1 1P 12/22/71
SYSTEM, STORAGE TO TRANSPORT, TRANSPORT TO SYSTEM LOADING AND UNLOADING PROCEDUR SYSTEM-EMERGENCIES HAZARDS PROTECTION GENERAL PRECAUTIONS APCI-IVE-1 2P 11/8/7 SYSTEM-EMERGENCIES HAZARDS PROTECTION APL-BULLETINS AND REPORTS ON VAKIOUS PROBLE SYSTEM-EMERGENCIES PROTECTION BUILDINGS AND ADJACENT SYSTEMS PROTECTION APCI-I SYSTEM-EMERGENCIES PROTECTION PERSONNEL APCI-IVCI-1 6P 1/13/72 SYSTEM-EMERGENCIES SAFETY TRAINING AND AREA PLACARDING APCI-IVA-1 4P 11/5/71 SYSTEM-EMERGENCIES WARNING DEVICES APCI-IVB-1 5P 11/12/71 TAPE THREE-M-FLUGROCARBON-TAPE, PERMACEL-TAPE APCI-MEMO-63 07/30/63 1P TAPE-SEAL THREAD LUBRICANT AND SEALER- TAPE-SEAL FROM FRIESLANG-PLASTIC COMPANY, P TAPE, SANDEM-INDUSTRIAL, CRANE PACKING CO APCI-ANAL-REP-70-368,70-369 1P 10/7 SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW SYSTEM INSTRUMENTATION AND CONTROL SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW GENERAL CONSIDERATIONS OF THE AGING SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW STRUCTURE APCI-IIIAI-1 1P 9/12/71 SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW LEAKS APCI-IIIA2-1 1P 9/12/71 SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW INSULATION CHECK APCI-IIIA4-1 1P SYSTEM CHECK AND INSPECTION WHERE WHY AND HOW PREVENTIVE MAINTENANCE PROGRAM IAPE PERCENT ETHER EXTRACTABLE CONTAMINANTS AND FLUGRESCENCE DAMCO-TEFLON TAPE, SAN CGA-PAMPHLET-341-TENTA TARE, SANDEM-INDUSTRIAL, CRANE PACKING CO APCI-ANAL-REP-70-308,70-309 I TARSET PIPE-CUATING THE PLASITE TESTS MANUFACTURED BY PITTSBURGH CHEMICAL TARSET PITTSBURGH CHEMICAL CO APCI-1A6A-01 IP 2/21/72 ASTM-SPEC STEEL-TYPE-304 UNIDENTIFIED AS TO 990000900 APCI CLEANING LOX STORAGE TANK-NO-6 SANTA/SUSANA — APCI-MEMO-64 03/11/64 IP PLUS | 1 990001950 SED GAS ASSUC INSULATED TANK-TRUCK SPECIFICATION CGA-341 FOK COLD LIQUEFIED-GASES 990000910 MASTEK, M.H. APCI LOX TANKS APCI-MEMO-70 06/26/70 IP 990000390 INTING- COLD-BOXES THERMAL TANKS PERLITE APCI-DES-ENG-STD-581.1 4P 5/26/61 990000410 NIING- COLD-BOXES, THERMAL TANKS, GLASS WOOL APCI-DES-ENG-STD-581.3 IP 10/24/60 APCI-IV-1 IP 12/23/71 TANKS, GLASS WUDL APCI-LL TANKS, GLASS WUDL APCI-LL TAPE APCI-IAZA-07 2P 2/21/72 1P 2/3/72 TANKS APCI-IIF1-3 SYSTEM-EMERGENCIES AND AND 990001150 FREDERICK,L. APCI TEFLON 990001130 OF CRUSSLITE FLUORGCARBUN SOLDERS, AND SULDERS, AND PROCRAM-PROGRAM-PROCRAM PROGRAM-PROGRAM-990005590 - UXYGEN-TRANSFER SYSTEMS 990005580 - GXYGEN-TRANSFER SYSTEMS 990005560 UN TO STORAGE, STORAGE TO 990005570 FER PRODUCTION, STORAGE TO CRYGGENIC LIQUID STURAGE 990004530 THREADING COMPOUNDS- DAMCO 990004540 HREADING COMPOUNDS- SANDEN FLUCRESCENCE DAMCU-TEFLON PROGRAM-APCI APCI APCI APCI APCI AND SURFACE IREATMENTS-BRUPHY, M. APCI APCI SOLDERS, A SOLDERS, A SOLDERS, A SOLDERS, A SOLDERS, A SOLDERS, MAINI ENANCE MA INTENANCE 990005770 PCI MAINTENANCE 990005790 PCI MAINTENANCE 990005810 PCI MAINTENANCE MAINTENANCE 990005030 TALS; ALLOYS; S 990005070 TALS; ALLOYS; S 990005060 TALS; ALLOYS; S 990005160 TALS; ALLOYS; S 990005120 TALS; ALLOYS; S 9900C5040 TALS, ALLOYS, ALLOYS, ALLOYS, 990005050 TALS, 990005700 APCI TLAS PC I 990005800 PCI 990005780 990005580 990001150 081500066 990004870 996005840 068400066 990005900 088500066 990005870 990005850 098500066 055100066 0901100066

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990001700 CUM-POMDER AS A LUARICANI, TANSET, PLASITE APCI-MAR-87-0-8821 IP 7762
990005240 EATMENTS- ALPHA BRASS-TYPE TCL-100 GR DTD-5019 TUNGUM CG LTD/UK COMPOSITION- COPPER-86-PERCENT ALUM-1.20-P 990005240 EATMENTS- ALPHA BRASS-TYPE TCL-100 GR DTD-5019 TUNGUM CG LTD/UK COMPOSITION- COHENATED-81PHENYL-A 990001690 LM-SPRAYABLE-A, DKILUBE-1, TEFLON DISPERSION-T-FILM, HYDROCARBON-GREASE, HYDRAULIC-COLL, CHLORINATED-BIPHENYL-A 990001690 LM-SPRAYELE APCI-MEMU-60 09/30/60 ZP PLUS IP ATTACHMENT PREDETKICK, A APCI TEFLON-HGSES, SUPPORTED BY BRAIDED STAINLESS-STEEL-HOUSING, AND RUBBEP-HGSES PLAS 990001300 KINETICS EXPERIMENTS- TEFLON-HGSES, SUPPORTED BY BRAIDED STAINLESS-STEEL-HOUSING, AND RUBBEP-HGSES PLAS 990001480 S AND THREADING COMPOUNDS- TEFLON-HGSES, SUPPORTED BY BRAIDED STAINLESS-STEEL-HOUSING, AND RUBBEP-HGSES PLAS 990001480 S AND THREADING COMPOUNDS- TEFLON-TAPE PERMACEL APCI-1AZA-02 ZP 2/21/72
990001480 POLYTETRAFLUGROETHYLENE, TEFLON-HGSES, SUPPORTED BY 2/21/72
990001480 POLYTETRAFLUGROETHYLENE, TEFLON-PORDIN MITH AR MILLIAM MCCORMICK REGARDING REQUIREMENTS FOR VENDO 990001220
990001400 POLYTETRAFLUGROETHYLENE, TEFLON-PRARTIUS, FLORNUBE-GREASES, EPOXY COMPGUNDS DEVCEN-F, FUAM-TY 990000600 XPLOSION TESTING- IGNITION LEST-APPARATUS, FLORNUBE-SEARS-THREAD-CUTTING-DIL APCI-ANAL-RE 990000510 RK-IGNITION-STANDARD BOMB TEST, LED-PLATE-251, PIPE-DORD APCI-MAR-87-0-8820 LP 9/61
990003910 TIGATION LE TRES ATTERAS INSTRUMENTS LTD-BEDFRO APLI-MAR-87-0-8820 LP 9/61
990003910 TIGATION LE TRES ATTERAS INSTRUMENTS LTD-BEDFRO APLI-MAR-87-0-8820 CUTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-COTTING-C
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INSULATIONS— TRANSITE, JOHNS—MANVILLE APCI-IA3A-02 IP 2
INSULATIONS— MINERAL—WOOL APCI-IA3A-04 IP 2/21/72
INSULATIONS— MILEOAM MILEOAM CORP APCI-1A3A-06 IP 2/21/7
INSULATIONS— GLASS—WOOL APCI-1A3A-03 IP 2/21/72
INSULATIONS— FGAMGLAS (CELLULAR—GLASS) INSULATION, PITTSB APCI-DES—ENG—STD—581.1 4P 5/26/61
JL APCI-DES—ENG—STD—581.3 IP 10/24/60
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      990003130 TSH#W.D.R. APCI CXY-TITE THREAD COMPOUND APCI IMO-NO-XD-0134 APCI-ANAL-REP-71-336 IP 10/22/71
99000090 w.w. APCI LUBRICANTS AND THREAD COMPOUNDS FOR OXYGEN-SYSTEMS APCI-SAFETY-GRAM-NO-27 5P 3/22/63
9900001140 YODER.L. APCI I-FILM THREAD COMPOUND, AUTOIGNITION TEST APCI-ANAL-REP-61-683 APCI-IMO-NO-80-0068 IP
990001110 R VARIOUS MATERIALS— ABMA THREAD LUBRICANT AND SEALANT, ANDEROL-L-536 RUSI-PREVENTIVE LEHIGH CHEMICAL CO-CHE
990001160 YGDER.L. APCI TAPE-SEAL THREAD LUBRICANT AND SEALER— TAPE-SEAL FROM FRIESLAND-PLASTIC COMPANY, PERMACEL-IA
990001190 OYER.W. A. APCI REGULATOR THREAD SEALANT MOLYLUBE-N APCI-MEMO-63 10/4/63 IP
990001180 PCI PIPING— APPROVED PIPE THREAD SEALANTS APCI-DES-ENG-STD-570.5.1 IP 11/11/60
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     990000740 LNUS-500, HYDRUCARBUN-GIL, TITANIUM-TETRACHLORIDE APCI-MAR-87-0-8822 3P 8763
990000750 SONVILLE-PLANT SCLNUS-500, TITANIUM-TETRACHLORIDE APCI-MAR-87-0-8822 2P 9763
990000740 ONT-NEW/JEHNSÜNVILLE-PLANT TITANIUM, TITANIUM-DIOXIDE, SOLNUS-500, HYDRUCARBUN-OIL, TITANIUM-TETRACHLORIDE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        INSULATIONS- NATIONAL-GYPSUM-BLUE NATIONAL-GYPSUM CORP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  APPROVED PIPE THREAD SCALAR WOLVINGEN APCINEMO-53 10/4/63 1P
APPROVED PIPE THREAD SCALAR WOLVINGEN APCINEMO-53 10/4/63 1P
APPROVED PIPE THREAD SCALARING APCINES-ENG-STD-570.5.1 1P 11/11/60
SCALANTS AND THREADING COMPOUNDS- CRANE PACKING CG-TAPE APCINIZA-09 2P 2/21/72
SCALANTS AND THREADING COMPOUNDS- CRASSLITE-FLUGROCARBON-TAPE APCINIZA-06 2P 2/21/72
SCALANTS AND THREADING COMPOUNDS- DAVINGEN APCINIZA-01 1P 2/21/72
SCALANTS AND THREADING COMPOUNDS- DAVINIZA-10 1P 2/21/72
SCALANTS AND THREADING COMPOUNDS- PERMATEX-1516 APCINIZA-01 1P 2/21/72
SCALANTS AND THREADING COMPOUNDS- POUTTI-ROPE NATIONAL GREENHOUSE CU APCINIZA-04 1P
SCALANTS AND THREADING COMPOUNDS- SADIUM-SILICATE APCINIZA-02 2P 2/21/72
SCALANTS AND THREADING COMPOUNDS- TEFLON-TAPE APCINIZA-02
SCALANTS AND THREADING COMPOUNDS- TEFLON-TAPE APCINIZA-02
SCALANTS AND THREADING COMPOUNDS- THREE-M FLUUROCARBON-TAPE APCINIZA-03 1P 2/21/72
SCALANTS AND THREADING COMPOUNDS- THREE-M FLUUROCARBON-TAPE APCINIZA-03 1P 2/21/72
SCALANTS AND THREADING COMPOUNDS- THREE-M FLUUROCARBON-TAPE APCINIZA-03 1P 2/21/72
SCALANTS AND THREADING COMPOUNDS- THREE-M FLUUROCARBON-TAPE APCINIZA-03 1P 2/21/72
SCALANTS AND THREADING COMPOUNDS- THREE-M FLUUROCARBON-TAPE APCINIZA-03 1P 2/21/72
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D-0134 APCI-ANAL-REP-71-336 1P 10/22/71
TEMS APCI-SAFETY-GRAM-NO-27 5P 3/22/63
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 990000376 HUSSNYILLE FLUURULARGUN 18PE IHREE-M-FLUOROCARBON-TAPE, PERMACEL-TAPE APCI-MEMO-63 07/30/63 IP
990000376 HUSSNYILLE-PLANT TITANIUM, TITANIUM-DIOXIDE, SOLNUS-500, HYOROCARSON-OIL, TITANIUM-TETRACHLORIDE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          APCI-145A-02 1P 2/21/72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    APCI-1A2A-11 2P 2/21/72
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                11/28/61
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          990004740 PCI GASKETS AND PACKINGS- TFE-GF-GREEN, MELRATH GASKETS CO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            APCI-MEMO-61
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               AND PAINTING- COLD-BOXES, THERMAL TANKS, GLASS WOOL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               THERMAL AND ELECTRICAL
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        990001100 EMBLY OF CAYGEN REGULATORS 1-FILM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     990000390 N AND PAINTING- COLD-BOXES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            990004660 SS-4004-SILICUNE-PRIMER GE
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APCI-1A24-03 1P 2/21/72

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990004490 S AND THREADING COMPOUNDS - T-FILM ECO MFGR

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YOCER, L. MAPCI T-FILM THREAD COMPOUND, AUTOIGNITION TEST APCI-ANAL-REP-61-663 APCI-IWO-NO-80-0
990001140
990000630 E-01L AMOCU-H-100, PENTUN, T-FILM-THREAD COMPOUND APCI-MAR-87-0-8821 IP 11/61
990003340 UNNEL-PROTECTIVE-EQUIPMENT TONNAGE AIR-SEPARATION PLANT APCI-SAFETY-STD-627.5.1 4P 6/15/70
990001030 PECTS OF RECONSTRUCTED ICI TONNAGE DAYGEN PLANT AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS 990002700 HANDLING OF REGULATURS AND TORCHES APCI-PAPER 17P PLUS 2P ATTACHMENTS 7/65
990000130 SCHMOYER, W. W. APCI HUMAN TORCHES APCI-SAFETY-GRAM-NO-500 IP 1/3/66
990002160 GROWTH-RATES AND FRACTURE TOUGHNESS STUDY OF WELDED ALUMINUM ALLOY-5083 ASME WINTER ANNUAL-MEETING NEW/Y
990002990 CYLINDER GAS CO OXYGEN TRAILER FIRE AICHE-CEP-TECH-MANUAL SAFETY IN AIR AND AMMONIA PLANTS V-4 PP4
990003070 UID-CARBONIC-LIQUID-OXYGEN TRAILER- ACCIDENT VICTORY-MEMORIAL-HOSPITAL 5/70 APCI-MEMO-71 06/3/71 17P
990005700 PERATIONAL-HAZARDS- DXYGEN TRANSFER EQUIPMENT MALFUNCTIONS AND FAILURES COMPRESSURS AND PUMPS APCI-IIF3-4
990001460 VALLEY-FORGE-GASKET-CO LOX TRANSFER FLUOROGREEN-E-600 APCI-MEMU-70 10/23/70 1P
                  PEGRAM, J. W. APL TRANSFER HOSE FOR CRYOGENIC LIQUIDS. APL-ENGR-SPEC-L.11 3P 7/7/69
990003750
990002660
             MASTER, H. H. APCI LOX TRANSFER PUMP SCREENS APCI-MEMO-69 01/24/69 2P PLUS 3P ATTACHMENTS
             MASTER HAHA APCI LOX TRANSFER PUMPS APCI-MEMO-68 12/30/68 2P PLUS 2P ATTACHMENTS
990002650
990001340 ER.E.G. APCL BEHAVIOR OF TRANSITE UNDER COMPRESSIVE-LOADS AT AMBIENT AND LIQUID-NITROGEN TEMPERATURES. A
990004600 D ELECTRICAL INSULATIONS- TRANSITE, JOHNS-MANVILLE APCI-IA3A-02 1P 2/21/72
                      APCI PIPING- TRANSITION-JOINTS AND ALUMINUM TO STAINLESS-STEEL APCI-DES-ENG-STD-579.15 2P 9/
990001890 IDE, CIS-DICHLOROETHYLENE, TRANS-DICHLOROETHYLENE, VINYLIDENA-CHLORIDE, TRICHLOROETHYLENE, ETHYL-ALCOHOL, METH
990003450 S USED FOR GASEOUS UXYGEN TRANSMISSION AND DISTRIBUTION CGA-DOCKET 70-11 CGA-THIRD DRAFT 23P 3/22/72
990004050 BON-STEEL GASEOUS OXYGEN TRANSMISSION-LINES APL-ENGR-STO-LS.30/2 3P 1/12/70
990005560 M, STORAGE TO TRANSPORT, TRANSPORT TO SYSTEM APCI-IIF1-1 1P 12/22/71
990005570 M, STORAGE TO TRANSPORT, TRANSPORT TO SYSTEM LOADING AND UNLOADING PROCEDURES FOR LIQUID OXYGEN TRANSFER
990003560 FICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE- MINIMUM FEDERAL SAFETY-STAND
990003540 FICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE- MINIMUM FEDERAL SAFETY-STAND
990003530 FICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE- MINIMUM FEDERAL SAFETY-STAND
990003570 FICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE-MINIMUM FEDERAL SAFETY-STAND
990003510 FICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE- MINIMUM FEDERAL SAFETY-STAND
990003520 FICE OF PIPELINE SAFETY TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE- MINIMUM FEDERAL SAFETY-STAND
990055640 LRUAD BARGE AND PIPELINE TRANSPORTATION ROAD. RAILROAD. BARGE AND PIPELINE TRANSPORTATION OXYGEN-DISPERSAL
990005820 NG PROCEDURES FOR FILTERS. TRAPS. AND INSTRUMENTS APCI-1118-1 2P 11/1/71
990001360 ROETHANE- TRICHLORDETHANE- TRICHLORETHYLENE- CARBON-TETRACHLORIDE- CHLOROFORM APC1-PRUJECT-NO-87-8-8821 AP
990005260 OLVENTS, AND MISC- 1,1,1 TRICHLURUETHANE APCI-1A7A-02 IP 2/21/72
990001890 GROETHANE, DICHLOROETHANE, TRICHLOROETHANE POLYMERS, POLYSULFIDE-SEALER, BUNA-N, NEOPRENE, EPOXY-ADHESIVE, PHE
990001360 -CHLORIDE- DICHLOROETHANE- TRICHLOROETHANE- TRICHLORETHYLENE- CARBON-TETRACHLORIDE- CHLOROFORM APCI-PROJECT-
990005290 CALS, SOLVENTS, AND MISC-TRICHLORGETHYLENE APCI-1A7A-05 1P 2/21/72
990001050 WHEN VAPOUR CLEANING WITH TRICHLURGETHYLENE (T.C.E.) APL-SAFETY-DEPT-INFU-SHEET-38 2P 2/10/71
990001890 LENE, VINYLIDENA-CHLORIDE, TRICHLORGETHYLENE, ETHYL-ALCOHOL, METHYL-ETHYL-KETONE, KEROSENE, GLYCERINE, POLYETH
990003700 ELMORE,G. APL SHELL AND TUBE-TYPE-COOLERS FOR OXYGEN SERVICE APL-ENGR-SPEC-E.05 13P 6/1/71
9906C3690 ELMORE,G. APL SHELL AND TUBE-TYPE-COOLER, OTHER THAN FOR OXYGEN SERVICE (APL-PLANTS) APL-ENGR-SPEC-E.04
990001890 EP-2-LIQUID, TURCO-4499-1, TUCRO-4499-2, TURCO-4499-3, TURCO-4499-5, TURCO-4499-6, ZYGLO-ZLIB-OIL-BASE, ZYGLO-
990005240 S-TYPE TCL-100 GR DTD-5019 TUNGUM CO LTD/UK COMPOSITION- COPPER-86-PERCENT ALUM-1.20-PERCENT NICKEL-1.4-P
990001890 G-DYE-CHECK-STEP-2-LIQUID, TURCG-4499-1, TUCRO-4499-2, TURCO-4499-3, TURCO-4499-5, TURCO-4499-6, ZYGLO-ZLIB-GI
990001890 URCU-4499-1, TUCRU-4499-2, TURCU-4499-3, TURCU-4499-5, TURCU-4499-6, ZYGLU-ZLIB-UIL-BASE, ZYGLU-ZL-2-PENETREX,
990001890 UCRO-4499-2, TURCO-4499-3, TURCO-4499-5, TURCO-4499-6, ZYGLO-ZLIB-OIL-BASE, ZYGLO-ZL-2-PENETREX, ZYGLO-ZL-22,
990001890 URCG-4499-3, TURCG-4499-5, TURCG-4499-6, ZYGLG-ZLIB-01L-BASE, ZYGLG-ZL-2-PENETREX, ZYGLG-ZL-22, ZYGLB-ZLX-396,
990001890 90, DYE-PROCESS-SOLUTIONS, TURCO-DYE-CHECK PROCESS, ZYGLO-ZE-2-EMULSIFIER, ZYGLO-ZP-5-DEVELOPER, PROTECTIVE-CO
990001890 USLO-PASTEIC IN KEROSENE, TURCO-DYE-CHECK-STEP-2-LIQUID, TURCO-4499-1, TUCRO-4499-2, TURCO-4499-3, TURCO-4499-
990003900 SON-I. APL ACCIDENT AT 1 TURNER LID PARK/LANE ROYTON DEDHAM LANCASTER 11940 AM 5/2/70 APL-SAFETY-DEP
990004840 NATURAL-UNTREATED-FINISH TURNERS ASBESTOS CEMENT CO LTD/UK APCI-1A5A-12 1P 2/21/72
990000710 RDS- DXYGEN-PRESSURE-GAUGE TWF WOOL, SPINTEX-305, MOLYKOTE-TYPE-Z AND TYPE-X-15 APC1-MAR-87-0-8822 1P 3/6
990003120 0XYGEN COMPATABILITY WITH TWO-PART EPOXY-COMPOUND (7343-RESIN- 7139-CATALYST) FROM CREST PRODUCTS CO. AP
990004860 CEMENTABLE FIFE TAPES TYGADUKE LTD/UK APCI-IA5A-14 1P 2/21/72
990004860 PCI GASKETS AND PACKINGS- TYCAFLOK CEMENTABLE PTFE TAPES TYGADURE LTD/UK APCI-IA5A-14 IP 2/21/72
990006750 YPE CUTTING-DILS, KNOWN AS TYPE-GROUP-II, PLANT WASH-UUT STUDIES, CELLULU8E-300, CELLULUBE-220 APCI-MAR-87-0
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UCON-LB283, UCUN-LB550, UCDN-LB300, UCON-LB170, UCON-HB170, UCON-HB660, AURALUBE-FS UCON-LB300, UCON-LB170, UCON-HB660, AURALUBE-FS UCON-LB300, UCON-LB170, UCON-HB660, AURALUBE-FS, KEL-F-UCON-LB550, UCON-LB300, UCON-LB170, UCON-HB660, AURALUBE-FS, FLUUROLUBE UCON-LB550, UCON-LB300, UCON-LB170, UCON-HB660, AURALUBE-FS, FLUUROLUBE UCON-TYPE LUBRICANTS, STEEL-PIPES APC1-MAR-87-0-8820 1P 4/61 AURALUBE-FS, FLUOROLUBE-FS, KEL-F-LF3, VERSILUBE-F-50, SFB1(40)-SILICU UCON-HB170, UCON-HB660, AURALUBE-FS, FLUORCLUBE-FS5, KEL-F-LF3, VERSILU DING OFFICIALS UNIFORM BULLOING CUDE VOL-1 1973
ETY- LOADING AND UNLOADING CPERATIONS APCI-SAFETY-STD-635.19 6P 2/08
STEM LOADING AND UNLOADING PROCEDURES FOR LIQUID OXYGEN TRANSFER APCI-IIF1-2 IP 8/22/71
EGRAM,J.W. APL UNSINTERED P.T.F.E. TAPE APL-ENGR-SPEC-L.14 2P 7/8/09
SYSTEMS MILFOAM URETHANE INSULATION NATIONAL-GYPSUM-BLUE LOX-SYSTEMS FOAM-GLASS LIQUID-HYDROGEN-PIP 990000340 ALCHUMOTION FAILURES VALVES APCI-IIF3A(3)-1 IP 12/30//11
990000340 I PIPINCTION FAILURES VALVES AND MATERIAL REQUIREMENTS APCI-UES-ENG-STO-579,3,1 2P 5/64
990000340 I PIPING- STAINLESS-STEEL VALVES AND SAFETY-RELIEF BEVICES APCI-SAFETY-STO-607,1,12 14P 10/62
990000460 -SEPARATION PLANT, PIPING, VALVES AND SAFETY-RELIEF BEVICES APCI-SAFETY-STO-607,1,12 14P 10/62
9900003460 APCI SAFETY RELIEF VALVES LOCATION AND PIPING-DESIGN CONSIDERATIONS APCI PIPING GROUP MEMO-19 10 990000110 SCHMUYER, w.w. aPCI VACUUM PUMP FAILURES APCI-SAFETY-GRAM-NU-35 IP 10/4/63
990002700 KITSON,F.K. APCI NASH VACUUM PUMPS APCI-HEMO-71 01/19/71 2P
99000490 PLANT COMPONENTS- STURAGE, VACUUM-SYSTEMS, AND COMPRESSED-GASES APCI-SAFETY-STD-607.2.2.5 P1-4 3/65 P5-6
990004750 PCI GASKETS AND PACKINGS- VALLEGREEN, VALLEY/FORGE GASKET CO APCI-IASA-03 IP 2/21/72
990004750 AND PACKINGS- VALLEGREEN, VALLEY/FORGE GASKET CO APCI-IASA-03 IP 2/21/72
990004750 AND PACKINGS- VALLEGREEN, VALLEY/FORGE GASKET CO APCI-IASA-03 IP 2/21/72
990003910 I. APL INVESTIGATION OF VALVE FIRES AT TEXAS INSTRUMENTS LTD-BEDFGRD APL-SAFETY-DEPT-REP-31 SP REV-1
990000350 IPIING- EXTENDED BONNET VALVE PRUCUREMENT AND CLEANING PROCEDURE APCI-DES-ENG-STD-579.5 3P 8/12/60 APC I - ANAL -R APC I-PROJECT-NO-U0-5-3246-51 APC 1-1 WC-NC-L A-033 APCI-SAFET 990003440
PEGRAM.J.W. APL VALVES-OXYGEN SERVICE—MINIMUM DECONTAMINATION AND TEST REQUIREMENTS APL-ENGR-SP 990003740
PEGRAM.J.S.W. APL RELIEF VALVES, WARM GAS SERVICE —20F TO 100F APL-ENGR-SPEC-J.18 4P 6/18/69
990003740
APCI LOX AND LIN VAPOR DISPOSAL—TANK—500—GAL APCI-DRAWING—92483D REV—B 9/30/68
990002510 MASTER,H-W. APCI PRODUCT VAPOR HZARDS—SAFETY INFORMATION RELATIVE TO LIQUID—VAPOR—CLOUDS APCI—PAPER 990000350 SUN—OIL COMPANY_S LOX—TANK VAPORIZER APCI—MEMO—64 04/9/64 IP PLUS IP ATTACHMENT
990000150 APCI PRESSURE—VESSELS—VAPORIZER AND CRYGGENIC LIQUID DISPOSAL APCI—DES—ENG—STD—514.6.2 4P 5/26/61
99000150 STEEL LTD OXYGEN PLANT VAPORIZER EXPLOSION AICHE—CEP—TECH—MANJAL SAFETY IN AIR AND AMMONIA PLANTS
990002500 N».L. APCI MISTY PROBLEM VAPOUR—CLOUDS FROM DEFROST OPERATIONS ALLEGEDLY CAUSED HIGHWAY ACCIDENT APCI—SAFET—38
99000150 TS ON INKILIATION WAPURA CLEANING WITH TRICHLORDETHYLENE (T.C.E.) APL—SAFETY—DEPT—INFO—SHEET—38 UCUN-HB660, AUKALUBE-FS, FLUDROLUBE-FS5, KEL-F-LF3, VERSILUBE-F-50, APCI-1161-1 2P 2/12/72 COMPRESSED GAS CYLINDER VALVE DUTLET AND INLET CONNECTIONS CGA-PAMPHLET-V-1 57P 1965
COMPRESSED GAS CYLINDER VALVE DUTLET AND INLET CONNECTIONS CSA-396 57P 1965
CGMPRESSED GAS CYLINDER VALVE DUTLET AND INLET CONNECTIONS ASA-857.1 57P 1965
MOYSAN.5.R. APCI VALVE WASHERS NEW AND USED QUALITATIVE AND QUANTITATIVE DIL ANALYSIS
D TEST OF 1/2-INCH SAFETY VALVE WITH CARBON STEEL SPRING APCI-INU-NU-10-7071 APCI-PROJECT-NO APCI-1181-2 1P 2/19/72 07/22/71 IP 990062930 TS ON INSULATION MATERIALS VASCOCEL MILFDAM NATIONAL-GYPSUM (GREEN) FUAM-GLAS (CGRNING) AP 990000840 APCI REQUIREMENTS FUR VENDOR CLASS-A CLEANING APCI-QUAL-CONT-LAYOUT-115F 2P 77.1/71 990000850 APCI REQUIREMENTS FUR VENDOR CLASS-AA CLEANING APCI-QUAL-CONT-LAYOUT-116F 2P 77.1/71 990000850 APCI REQUIREMENTS FUR VENDUR CLASS-AAA CLEANING APCI-QUAL-CONT-LAYOUT-117F 3P 77.1/71 990000050 APCI REQUIREMENTS FUR VENDUR CLASS-AAA CLEANING APCI-QUAL-CONT-LAYOUT-117F 3P 77.1/71 APCI-MEMO-71 00E APCI-DES-ENG-STD-579.3 12P 1/63 APCI-DES-ENG-STD-537.9 4P 7/65 VENDOR-CLASS-AA AND CLASS-AAA CLEANING APCI-VENTED GASES CLEANLINESS OF DISPOSAL SYSTEM VENTED GASES CLEANLINESS OF DXYGEN PIPING APCI-MEMO-63 11/1/63 3P UCON-LET 70, UCUN-HB660, 990001830 PIPING- INTRODUCTION HANG VALVE-CODE 990000240 IREMENTS SAFETY AND RELIEF VALVES AP UNARCO 990001400 0, UCUN-L8283, UCON-L8550, 990001400 CELLULUBE-150, UCON-L8283, 3, UCON-L8550, UCON-L8300, 990001400 LULUBE-220, CELLULUBE-150, 990003440 E UF BUILDING OFFICIALS 990001940 FLEET SAFETY- LOADING AND 9900C5570 ORT TO SYSTEM LOADING AND 0, UCDN-LB170, UCDN-HB170, 990000590 US, AND EXPLOSION TESTING-990002920 DEN-POINT OF AIR-SYSTEMS 990005450 IUNAL-HAZARĒS- DISPOSAL DE 990005470 IUNAL-HAZARDS, DISPOSAL DE 990002220 REGARDING REQUIREMENTS FOR 990005440 ICNAL-HAZARUS- DISPUSAL OF PEGRAM, J. W. APL 990002920 CRYGGENIC 990001400 990001400 990001850 990003770 990002340 990002350 990002370 9900C1430

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990003050 /KA-4-IV OXYGEN COMPRESSOR
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                                                                         990000410 UXES, THERMAL TANKS, GLASS
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                                                                                                                                                                                                                                                                                     VGEN-FUEL GAS SYSTEMS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         PCI GASKETS AND PACKINGS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         D-OXYGEN TRAILER- ACCIDENT
                                                                                                    ON TESTING- PINE AND MAPLE
                                                                                                                              EATMENTS- PLASITE-NO-7122H
                                                                                                                                                    -NEW/BRUNSWICK/NEW/JERSEY,
                                                                                                                                                                              T CONCRETE FLOOR TREATMENT
                                                                                                                                                                                                                                                            ELUING SCIETY SAFETY IN
                                                                                                                                                                                                                                                                                                                                                                                            RACTURE TOUGHNESS STUDY OF
                                                                                                                                                                                                                                                                                                                                                                                                                   NNEL-PROTECTIVE-EQUIPMENT-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   WN AS TYPE-GROUP-II, PLANT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 SAFETY-WALK-TYPE-B-M-0070, WALK-SYNTHETIC-CORK, MASKING-TAPE, SHERLUCK-LEAK-DETECTOR-TYPE-CG, SHERLOCK-LEAK DE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      PCI GASKETS AND PACKINGS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        PCI CXYGEN INDEX RATING
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        OMPRESSOR VITON-A (BLACK)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         F. POLYHEXAFLUOROPROPYLENE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       U PIPELINE
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            FLUOROLUBE-FS5, KEL-F-LF3,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ING VITON-O-RING MATERIAL-
                                                                                                                                                                                                                              FUR AIR-PRODUCTS REDI-SET
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 APCI SYSTEM-EMERGENCIES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            ICATION FOR DXYGEN SERVICE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 BYRON-JACKSON DXYGEN PUMP
TEGXAM, J. W.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               MOYSAN, S.R. APCI VALVE GILLOTT, E. APL SOLVENT
                                                                                                                                                                                                       DXYGEN REGULATORS IN THE
                      QUALITY CONTROL OF ROCK
                                                WUALITY CONTROL OF RUCK
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              PLANT EQUIPMENT SOLVENT
APCI PLANT SOLVENT
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      GASKETS AND PACKINGS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       ACCIDENT ARISING FROM VENTING-UXYGEN MANIFOLDS CONNECTED TO A COMMON
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            KITSON F.K. APCI
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               APCI LUBRICANTS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                PRESSURE-VESSELS-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       TRANSPORTATION
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           SYSTEM DUE TO
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MINEXAL
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                                                                                                                                                                                                                                                                                                                FUR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 WASHOUT ANALYSIS OF SUN-OIL COMPANY_S LOX-TANK VAPORIZEP APCI-MEMO-64 04/9
WASHOUT PROCEDURE FUR ANALYTICAL PURPOSES APCI-PUM-SEC-1.07 60 --- WASHOUT-FREQUENCIES APCI-DOM-SEC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  VITON A VINYLIDEND FLUGRIDE, POLYDIMETHYLSILOXANE, FLUGRINATED-SILOXANE, LS-53, BUT VITON-A DUPONT APCI-IA4A-06 IP 2/21/72 VITON-A GUPONT APCI-IA5A-11 IP 2/21/72 VITON-A (BLACK) GARLOCK-900 JOHNS-MANVILLE .ASBESTOS-61 SHEET APCI-ANAL-REP-71 VITON-A (BLACK) VITON-E-60 (GREEN) DEMAG-LETTER TO APCI IP 8/11/71 VITON-E-60 (GREEN) DEMAG-LETTER TO APCI IP 8/11/71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       VIBRATION AND CONTROLLED SLOSHING APCI-IIF2E-1 IP VIBRATIONS DETERIDEATION APCI-IIF3C-1 IP 12/30/71 VIBRATIONS, SHOCK (THERMAL AND PRESSURE), LINE-SURGES VICTORY-MEMORIAL-HOSPITAL 5/70 APCI-MEMO-71 06/3/71
                      HOOL
                                                                         MOOL
                                                                                                                                                                                                                                       WELDING APCI-IB2D-1 2P 10/20/11
WELDING AND BRAZING PROCEDURES, WELDERS, BRAZERS, AND WELDING AND WELDING AND WELDING AND WELDING AND WELDING WELDING AND CUTTING AND WELDING WELDING AND CUTTING USAS-Z49.1 49P 1967
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                                                  MOGL
                                                                                                                                                  WEST CHEMICAL PRODUCTS INC, ALUMINUM-DXIDE, SEAM COMPGUND GEON POLYVINYLCHLORIDE, WEST CONCRETE FLOOR TREATMENT WEST CHEMICAL PRODUCTS INC, ALUMINUM-DXIDE, SEAM CO
                                                                                                                                                                                                                              WELDING AND CUTTING DUTFITS APCI-BROCHURE 11P 9/25/69
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               WASHING OF PIPING SYSTEMS APL-IGD-ENGR-MAN-56-06 4P 7/3/71 WASH-OUT STUDIES, CELLULUBE-300, CELLULUBE-220 APC1-MAR-87-0-
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 WASHERS NEW AND USED QUALITATIVE AND QUANTITATIVE OIL ANALYSIS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          WARNING DEVICES APCI-IVB-1 5P 11/12/71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               VITON-C-KING MATERIAL- VITON-E-60 (GREEN) VITON-A (BLACK) GARLOCK-900 JOHNS-MANVI
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                                                                                                    WGOU, ACTIVATED CARSON
                                                                                                                           WISCONSIN PROTECTIVE COATING CO
                                                                                                                                                                                                                                                                                                                                                              WELDED, LOW-PRESSURE STORAGE
                                                                                                                                                                                                                                                                                                                                                                                     WELDED ALUMINUM ALLOY-5083
                                                                                                                                                                                                                                                                                                                                                                                                                   WEARING APPAREL HARD HATS
                                                                                                                                                                                                                                                                                                                                                                                                                                              WEAR SAFETY SHOES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   WATER-HAMMER IN CRYDGENIC TRANSFER-LINES BIBLIDGRAPHY
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      VULCANIZED-RED-FIBRE-GASKETS APCI-IASA-08 IP 2/21/72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    VIIUN A
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       VINYLIDEND FLUGRIDE, PULYDIMETHYLSILOXANE, FLUGRINATED-SILOXANE, LS-53, BUTYL-RUBBE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         VESSEL REPAIRS
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             VINYL-CHLORIDE, CIS-DICHLORUETHYLENE, TRANS-DICHLURDETHYLENE, VINYLIDENA-CHLORIDE,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                VINYLIDENA-CHLOKIDE, TRICHLORGETHYLENE, ETHYL-ALCOHOL, METHYL-ETHYL-KETONE, KEROSEN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              VESSEL-DESIGN-BASIS AND GENERAL STANDARDS
                    APCI-MEMU 2 HIMMELBERGER,F.
APCI-MEMO-59 11/6/59 2P
APL-ENGR-SPEC-N.U2
                                                                         APCI-DES-ENG-STU-581.3 IP IC/24/00
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EN APCI-POM-SEC-1.05 12P 2/20/67
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                                                                                                    APCI-MAR-87-0-8321 IP 10/61
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ASME WINTER ANNUAL-MEETING
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                                                                                                                              APC1-146A-03 1P
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                                                  QUALITY CONTROL OF
                                                                                                                                                                                                       11/26/67
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                                                  ROCK WOUL
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PROCESSES
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990001470 APCI PRODUCTION OF ROCK WOOL BETHLEHEM-STEEL-CO APCI-MEMG-59 11/12/59 2P
990001310 TANCE OF FIBERIZED MINERAL WOOL INSULATION APCI-QUAL-CONT-LAYOUT-103L 2P 7/1/71
990000710 CXYGEN-PRESSURE-GAUGE THE WOOL, SPINTEX-305, MOLYKGTE-TYPE-Z AND TYPE-X-L5 APCI-MAR-87-0-8822 1P 3/63
990002030 CCNTROL PROCEDURE- SAFETY WORK-PERMIT APCI-POM-SEC-1.04 3P PLUS EXHIBIT-A IP 2/16/67
990004200 LACK OF OXYGEN KILLS TWO WORKMEN APL-SAFETY-BULL-037 1P REPRINTED 1/68

990003800 NARY REPORT ON ACCIDENT AT ZELZATE PLANT 2/26/69 WHEN AN EXPLUSION AND FIRE GCCURRED IN BURCKHARDT CENTRIFUG 990005230 POSITION CU-58 1-PERCENT ZN38.5-42-PERCENT PBO.35-.9-PERCENT APCI-1A6A-37 1P 2/21/72 990001890 TURCU-DYE-CHECK PROCESS, ZYGLO-ZE-ZE-EMULSIFIER, ZYGLO-ZE-5-DEVELOPER, PROTECTIVE-COATINGS, DOW-CORNING-SILIC 990001890 URCO-4499-6, TURCO-4499-6, ZYGLO-ZL18-0IL-BASE, ZYGLO-ZL-2-PENETREX, ZYGLO-ZL-22, ZYGLO-ZLX-390, DYE-PROCESS-90001890 BASE, ZYGLO-ZL-2-PENETREX, ZYG

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990002620 HEMICAL CO DXYGEN FIRES
                                                                                                                          990001150 TRIAL, CRANE PACKING
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                                                                                                                                                       990001420 REUCK-900, KM-226, KM-246
                                                                                                                                                                      990001430
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990003000 E IN A LIQUID GXYGEN PUMP
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                                                                                                                                                                                                                                     990001300 ATING-MATERIAL FUAM GLASS
                                                                                                                                                                                                                                                    990001330 N 100-PERCENT UXYGEN ATM
                                                                                                                                                                                                                                                                  990001160 IC COMPANY, PERMACEL-TAPE
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                                                                          TLL E
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                                                                                                                                                                                                                                                                                                  GRAGE-TANK (FLAT-BOTTOM)
                                                                                                                                                                                                                                                                                                                                                             SAMPLING, AND ANALYSIS -REP-70-013,70-014,70-015
                                                                                                                                                                                                                                                                                                                                                                                                                          TRIBUTION PIPING SYSTEMS OXY-TITE THREAD COMPOUND
               DING AND CUTTING
                                                                                                          900
                                                                                                                                                                       UANTITATIVE OIL ANALYSIS
                                                                                                                                                                                     MPOUND, AUTOIGNITION TEST
                                                                                                                                                                                                                                                                                                                 ANING FOR DXYGEN SERVICE
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AND COMPRESSED
                                                                            . ASBESTOS-61 SHEET
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                                             APCI-IWO-NU-XU-0128
                                                                                           APCI IWO-NO-XU-0134
                                                                                                          APCI-IND-NO-LB-0795
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ANSI-031-5 6-0 1968

ANSI-031-8 108P 1968

ANSI-031-8 108P 1968

APCI IWO-NO-XD-0134 APCI-ANAL-REP-71-336 1P 10/22/71

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                                    APCI-IALA-11
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990004400 L-RAY CO FARMINGDALE/NJ
                                    APCI-IAIA-12
                                                 1P 2/21/72
990004410 BE PRODUCTS GLEN/COVE/NY
                                    APCI-IA1A-13
                                                 1P 2/21/72
990004420 UURC-GLIDE, CHEMPLAST INC
                                    APCI-IA1A-14
                                                      2/21/72
990004430 KRYTOX-143-AD-UIL DUPONT
                                    APCI-IAIA-15
                                                 1P 2/21/72
990004440 NGSLEY AND KEITH LTD/UK
                                    APC1-IA1A-16
                                                 1P 2/21/72
990004450 BRICANTS- ESSO BEACON-325
                                    APCI-IAIA-17
                                                  1P 2/21/72
990004460 IN-YO4 MONTECATINI-EDISJN
                                    APCI-IA1A-18
                                                  1P 2/21/72
990004476 COMPOUNDS- PERMATEX-1516
                                    APCI-IA2A-01
                                                  1P
                                                      2/21/72
990004480 NDS- TEFLUN-TAPE PERMACEL
                                    APCI-IAZA-02
                                                  2P
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990004490 NDS- T-FILM ECO MFGR CO
                                    APCI-IAZA-03
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990004500 NATIONAL GREENHUUSE LU
                                    APCI-IA2A-04
                                                      2/21/72
                                                 1 P
                                                 1P
990004510 L-RAY CO FARMINGDALE/NJ
                                    APCI-IAZA-05
                                                      2/21/72
990J04520 USSLITE-FLUURGCARBON-TAPE
                                    APCI-IAZA-06 2P
                                                      2/21/72
990004530 ING COMPOUNDS- DAMCO TAPE
                                    APCI-IA2A-07 2P
                                                      2/21/72
990004540 No COMPOUNDS- SANDEN TAPE
                                    APCI-1A24-08 2P
                                                      2/21/72
990004550 - CRANE PACKING CO-TAPE
                                    APCI-IA2A-09
                                                      2/21/72
                                                 2P
990004560 READING COMPOUNDS- GXOMAT
                                    APCI-IA2A-10 IP
                                                      2/21/72
                                    APCI-IA2A-11 2P
990004570 THREE-M FLUOROCARBON-TAPE
                                                      2/21/72
                                    APCI-IAZA-12 1P
                                                      2/21/72
990004580 CATE AND CHINA-CLAY-PASTE
                                    APCI-IA3A-OL IP
990004590
          PITTSBURGH-CORNING CORP
                                                      2/21/72
990004600 TRANSITE, JOHNS-MANVILLE
                                    APCI-IA3A-02
                                                 1P
                                                      2/21/72
990004610
          INSULATIONS- GLASS-WOOL
                                    APCI-IA3A-03
                                                 1P
                                                      2/21/72
990004620 INSULATIONS- MINERAL-WOOL
                                    APCI-IA3A-04
                                                 LP
                                                      2/21/72
990004630 CAL INSULATIONS- PERLITE
                                    APCI-IA3A-05
                                                 1 P
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990004640 ONS- MILFOAM MILFOAM CORP
                                    APCI-IA3A-06
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     APCI-146A-09
APCI-146A-10
APCI-145A-11
APCI-145A-11
   APC I - IA3A-07
APC I - IA4A-01
APC I - IA4A-01
APC I - IA4A-02
APC I - IA4A-04
APC I - IA4A-06
APC I - IA5A-01
APC I - IA5A-01
APC I - IA5A-02
APC I - IA5A-02
APC I - IA5A-03
APC I - IA5A-03
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APCI-1A5A-12
APCI-1A5A-13
APCI-1A5A-13
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APC I – IA5A–08
APC I – IA5A–09
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APCI-IA6A-22
APCI-IA6A-23
APCI-IA6A-24
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APC I - 1 46 A - 08
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APCI-1A6A-02
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APC1-1A6A-06
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990004650 BLUE NATIONAL-GYPSUM CORP
990004660 MULITE-12-CURING-CATALYST
990004680 AND ADHESIVES- KEENE-BINDER
990004090 ERS, AND ADHESIVES- NYLON
990004710 ADHESIVES- NYLON
990004710 ADHESIVES- NYLON
990004720 VES- NYLON-66 ICI LTD/UK
990004730 REGNATED-ASBESTUS-PACKING
990004730 REGNATED-ASBESTUS-PACKING
990004740 EEN, MELRATH GASKETS CU
990004760 REN- MELRATH GASKETS CO
990004760 REN- MELRATH GASKETS SESTOS GASKET MATERIAL)
990004780 ATERIAL MICOLET INDUSTRIES SPO0004800 PACKINGS- TEFLON, DUPONT
990004820 PACKINGS- VITON-A DUPONT
990004840 STUS CEMENT COLLD/UK
                                                                                                                                                                                                                                                                                     990004800 E TAPES TYGADURE LTD/UK
990004870 T PITTSBURCH CHEMICAL CO
990004880 I-97 BENJAMIN FGSTER CO
990004900 NTS- COPPER-PIPE ASTM-B42
990004900 NTS- COPPER-PIPE ASTM-B43
990004910 NTS- COPPER-TUBE ASTM-B43
990004910 NTS- COPPER-TUBE ASTM-B43
990004910 LUMINUM ASTM-B210-2024-T4
990004990 LUMINUM ASTM-B210-6061-T6
990004990 LUMINUM ASTM-B210-6061-T6
990004990 LUMINUM ASTM-B210-6061-T6
990004990 LUMINUM ASTM-B241-6061-T6
990004990 NSTEEL ASTM-B210-F061-T6
990005000 NSTEEL ASTM-B304-B304
990005000 NSTEEL ASTM-A312-TP304
990005000 NSTEEL ASTM-A312-TP304
990005000 FSS STEEL ASTM-A312-B304
990005000 FSS STEEL ASTM-A312-B304
990005000 FSS STEEL ASTM-A312-B316
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NLESS STEEL ASTM-A269-304
- BRONZE ASTM-B61 UR B62
-SHEET GR PLATE ASTM-B36
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       EATMENTS- MONEE ASTM-BL64
SS STEEL ASTM-A351-GK-CF8
NICKEL STEEL ASTM-A353GB
TS- COPPER-TUBE ASTM-BB8
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APCI-PROJECI-NO-00-5-3246-51,12,50
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APCI-ANAL-REP-71-446 1P
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APCI-IWG-NG-81-0018
APCI-IWG-NG-81-0095
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                                         99005760 EKE WHY AND HOW STRUCTURE 990005770 N WHERE WHY AND HOW LEAKS 990005780 RUMENTATION AND CCNTROLS 990005790 AND HOW INSULATION CHECK 990005800 IGNS OF THE AGING SYSTEM 99000581G IVE MAINTENANCE PROGRAM
                                                                                                                                                                                     990005860 ERGENCIES WARNING DEVICES 990005876 CIES PROTECTION PERSONNEL 990005880 CENT SYSTEMS PROTECTION 990005890 CTICN GENERAL PRECAUTIONS
                           990005750 RDS- FIRES AND EXPLOSIONS
                                                                                                                                        990005820 S, TRAPS, AND INSTRUMENTS
990005830 PROGRAM PRESSURE TESTING
990005850 ING AND AREA PLACARDING
               TH UTHER DXYGEN-EQUIPMENT
                                                                                                                                                                                                                                                    RELATED TO UXYGEN-SAFETY APCI SYSTEM-EMERGENCIES
                                                                                                                                                                                                                                                                                  -034 TO 61-40 AND 61-42
EN APCI-ANAL-REP-61-435
 RES COMPRESSORS AND PUMPS
                                                                                                                                                                                                                                                                                                                     APCI-TR-53
                                                                                                                                                                                                                                                                                                                                   WITH CARBON STEEL SPRING
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990001350 OMPOUND SQ-32 AND VITON A
990001410 OC APCI-ANAL-REP-70-026
                                                                                                                                                                                                                                                                                                                                                                                                                                                          990001870 YGEN-NITRDGEN-ATMOSPHERES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                           STYLE-NO-61 GARLOCK-900
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       990003120 FROM CREST PRODUCTS CO
990003420 ITY LOX/LIN STORAGE TANK
990000590 E LUBRICANTS, STEEL-PIPES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       990000580 A-HCSES PLASITE-NG-7122H
990000600 ANE FOAM (EPON-FDAM-H-60)
990000610 LED-PLATE-251, PIPE-DOPE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            70-014,70-015 APCI-123
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    990000640 CYL-SEAL SEALING COMPOUND
                                                                                                                                                                                                                                                                                                                                                                                                                                           EEN) FOAM-GLAS (CORNING)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      LE "OUD, ACTIVATED CARBON
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    PREGNATED FIBERGLASS LAVA
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           990003060 E-0-RING (1/8-INCH DIA)
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990001130 ARBUN-TAPE, PERMACEL-TAPE
990000940 EANING FUR OXYGEN SERVICE
990002610 MP EXPLUSION AIRCO-BUTLER
990001190 THREAD SEALANT MOLYLUBE-N
990002920 NT OF AIR-SYSTEMS UNARCO
                                                                                                                                                                                                                                                                                                                                       990000900 GE TANK-NG-6 SANTA/SUSANA
9900002570 ECIALIY-GAS GAUGE-FAILURE
990000920 PANY_S LOX-TANK VAPORIZER
9900002250 I-OPER-MAN-VGL-4-SECT-6.3
                                                                                                                                                                                          990001070 AND OF METHYLENE-CHLURIDE
990001360 APCI-PRGJECT-NO-87-3-8821
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      NG) APCI-IWO-NO-LA-0333
APCI LOX IRANSFER PUMPS
L, TITANIUM-TETRACHLURIDE
                           LEAD SEAL-NO-2-JOHN CRANE
                                          K WOOL BETHLEHEM-STEEL-CO
                                                         990001450 ITY CONTROL OF ROCK WOOL
990001120 FLAMMABILITY TEMPERATURE
                                                                                     990001500 LASITE PRUTECTIVE CUATING
                                                                                                   ON COATED ASBESTUS-BLUE
A FLOWING GXYGEN STREAM
                                                                                                                               990002740 APCI-PROJECT-NO-87-0-8320
                                                                                                                                              TAKEN ON PRESSURE-GAUGES
                                                                                                                                                               990001000 ESTS OF T-FILM AND PENTON
                                                                                                                                                                           OXYGEN REGULATORS T-FILM
                                                                                                                                                                                                                       990000890 CI STÜRAGE TANK CLEANING
                                                                                                                                                                                                                                     990001320 YGEN COMPATIBILITY- NYLUN
                                                                                                                                                                                                                                                                                                                                                                                                  990002770 OR ACCIDENT- GRANITE/CITY
990002780 T- GRANITE/CITY FACILITY
                                                                                                                                                                                                                                                                                                                                                                                                                                DXYGEN PIPE-LINE FAILURE
                                                                                                                                                                                                                                                                                                                                                                                                                                             990002240 N QUALITY-CONTROL-SAMPLES
                                                                                                                                                                                                                                                                                                                                                                                                                                                             990302200 DX-SPILL NCG CONSHOHOCKEN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                           990G02840 QUIPMENT FAILURE SHAKOPEE
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       -MISS ACCIDENT- CREIGHTON
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990001380 APC1 HALDCARBON-WAX-6-25
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                990002730 LOW-METER RING SEAL-FLUID
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              99000091U TER,H.H. APCI LOX TANKS
990002580 PUMP FIRES AND EXPLOSIUNS
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SYSTEM
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              ITY CONTROL OF RUCK WOOL
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990002210 CLEANLINESS REQUIREMENTS
                                     APC 1-MEMC+71 07/22/71 2P
990002910 XYGEN COMPRESSOR SUCTION
                                     APCI-MENU-71 07/26/71 2P
                                     APCI-MEMO-71 12/10/71 1P
990003400 UDY PROJECT 00-1-2495-07
990002670 COSMODYNE LOX-PUMP SAFETY
                                     APCI-MEMO-71 1/01/26/71 2P
990002680 D. APCT LOX-PUMP SAFETY
                                     APCI-MEMO-71 2/19/71 1P
990003420 ION FOR JOB-NO-00-2-2775
                                     APCI-NO-71-2775-16.10-1A 2P 9/16/71
990002700 OF REGULATURS AND TORCHES
                                     APCI-PAPER 17P PLUS 2P ATTACHMENTS 7/65
990002510 VE TO LIQUID-VAPOR-CLOUDS
                                     APCI-PAPER 7P 1971
990001040 ION-EQUIPMENT MAINTENANCE
                                     APCI-POM-1.12 7P 4/21/67
990002020 CATROL PROCEDURE- TAG OUT
                                     APCI-POM-SEC-1.03
                                                        2P PLUS EXHIBIT-A 1P 2/15/67
990002030 EDURE- SAFETY WORK-PERMIT
                                     APCI-POM-SEC-1.04
                                                       3P PLUS EXHIBIT-A 1P 2/16/67
990000990 T SOLVENT WASHOUT-GENERAL
                                     APCI-POM-SEC-1.05
                                                       12P 2/20/67
990002860 FUR ANALYTICAL PURPOSES
                                                       5P 7/7/70
                                     APCI-POM-SEC-1.07
990000950 NTS AND IN DXYGEN SERVICE
                                     APCI-POM-SEC-1.08
                                                       7P PLUS 3P ATTACHMENTS 4/4/67
990003310 RTABLE FIRE-EXTINGUISHERS
                                     APCI-POM-SEC-1.13
                                                       5P 3/30/67
990002270
              APCI COLD-BOX LEAKS
                                     APCI-POM-SEC-1.14
                                                       5P
                                                           10/30/68
990002830 AND ASSOCIATED EQUIPMENT
                                     APCI-POM-SEC-1-17
                                                       88
                                                           4/23/69
990002380 ACITY OR LARGER! GENERAL
                                     APCI-POM-SEC-2-02
                                                       7P PLUS EXHIBITS ABCDEFG 8/29/69
990000980 LVENT WASHOUT-FREQUENCIES
                                     APCI-POM-SEC-5.07
                                                       3Ρ
                                                           7/15/70
990002530 INDUSTRIAL SAFETY POLICY
                                     APCI-POM-SEC-5-16
                                                       7P
                                                           10/30/68
990002330 SAFETY REPORTS AND FORMS
                                     APCI-POM-SEC-5.18
                                                       6P PLUS EXHIBITS ABCDEFGH 3/3/70
990002550 APCI ACCIDENT REPURTING
                                     APCI-PUM-SEC-5.21
                                                       4P PLUS APPENDIX-A EXHIBIT-A 5/8/68
990002300 -VALVES AND RUPTURE-DISCS
                                     APCI-POM-SEC-6.02 19P INCLUDING EXHIBITS ABCDE 12/8/64
990002290 ON PREVENTIVE MAINTENANCE
                                     APCI-POM-SEC-6.05
                                                       5P 10/30/68
990002040 PCI CODED VESSEL REPAIRS
                                     APCI-POM-SEC-6.09
                                                       4P 11/29/68 FOR ATTCHMTS SEE 205 206 207
990002280 PCI CODED VESSEL REPAIRS
                                     APCI-PUN-SEC-6.09 4P 15P OF ATTCHMTS 11/29/68
990002050 TH MARYLAND CASUALTY CO
                                     APCI-POM-SEC-6.09-ATTCHMT-1 2P 8/27/69
                                     APCI-PROJECT-NO-00-5-3246-51.12.50 APCI-TM-079 3P 4/27/65
990001850 ING APCI-INO-NO-10-7071
990001880 IN AN OXYGEN-ATMOSPHERE
                                     APCI-PROJECT-NO-00-7-3480-51.00 APCI-TM-114 5P 6/24/08
                                     APCI-PROJECT-NO-87-0-8820 APCI-MEMO-61 06/28/61 5P
990002740 SURE-GAGES SAFETY DEVICES
                                     APCI-PROJECT-NU-87-0-8820/1 8P 11/17/61
990001090 OF STANDARD IGNITION TEST
990001360 TETRACHLORIDE- CHLOROFORM
                                     APCI-PROJECT-NO-87-8-8821
                                                                APCI-MEMO-62 01/3/62 5P
                                     APCI-QUAL-CONT-LAYOUT-101F 2P PLUS 5P OF ATTCHMTS 7/1/71
990000770 S FOR AIR-PLANT EQUIPMENT
990000780 S'USED FOR OXYGEN SERVICE
                                     APCI-QUAL-CONT-LAYOUT-102F 3P 7/1/71
990001310 U MINERAL WOOL INSULATION
                                     APCI-QUAL-CONT-LAYOUT-103L
                                                                2P 7/1/71
990002850 MANUFACTURING FACILITIES
                                     APCI-QUAL-CONT-LAYOUT-103F
                                                               11P REV 12/14/65
990000790 CLEANLINESS REQUIREMENTS
                                     APCI-QUAL-CONT-LAYOUT-104F
                                                                19 7/1/71
990002070 PNEUMATIC TESTING-GENERAL
                                     APC I-QUAL-CONT-LAYOUT-1054
                                                                3P
                                                                    7/1/71
990000800 CLEANLINESS REQUIREMENTS
                                     APCI-QUAL-CONT-LAYOUT-105F
                                                                3P
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990000810 CLEANLINESS REQUIREMENTS
                                     APC 1-QUAL-CONT-LAYOUT-106F
                                                                    7/1/71
990000820 CLEANLINESS REQUIREMENTS
                                     APCI-QUAL-CONT-LAYOUT-107F
                                                                    7/1/71
990000830 R VENDOR CLASS-B CLEANING
                                     APCI-QUAL-CONT-LAYOUT-114F
                                                                    7/1/71
990000840 R VENDOR CLASS-A CLEANING
                                     APCI-QUAL-CONT-LAYOUT-115F
                                                                    7/1/71
990000850 VENDOR CLASS-AA CLEANING
                                     APCI-QUAL-CONT-LAYOUT-116F
                                                                    7/1/71
990002060 DRUSTATIC TESTING-GENERAL
                                     APCI-GUAL-CONT-LAYOUT-LI7A
                                                                29
                                                                    7/1/71
990000860 VENDOR CLASS-AAA CLEANING
                                     APCI-QUAL-CONT-LAYOUT-117F
                                                                    7/1/71
                                                                312
990000870 GER CLEANING REQUIREMENTS
                                     APCI-GUAL-CONT-LAYOUT-119F
                                                                    7/1/71
                                                                2P
990000880 SPECIFIED PAINT SYSTEMS
                                     APCI-QUAL-CONT-LAYOUT-120F 3P
                                                                   7/1/71
                                     APCI-R+D-NOTEBOOK-111 P129-32
990001490 PITTSBURGH CHEMICAL CO
                                                                    4P 7/62
                                     APCI-R+D-NOTEBOOK-111 P149 IP 1/63
990001370 NO- RTV-60-NP-134372-M235
990001220 WITH HIGH-PRESSURE OXYGEN
                                     APCI-R+D-NOTEBOOK-III PI52 IP 1/63
                                     APCI-R+U-NOTEBUUK-111 P26-9 4P 4/17/61
990001480 APCI PIPE BURNING TESTS
990001200 BE-KOTE-AR AND MOLYLUBE-N
                                     APCI-R+D-NOTEBOOK-130 P16-7 2P
                                                                      2/11/63
990001230 WITH HIGH-PRESSURE CXYGEN
                                     APCI-R+D-NUTE800K-130 P3 1P 6/63
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                                                                                                                                                                                                              W. APCI GASEGUS DXYGEN
PCI DRAIN-LINE EXPLOSION
                                                                    A CYLINDER INTO A ROCKET
                                                                                     990000020 APCI FIRE IN DXYGEN-LINE
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                                                                                                                                                                              Y CAUSED HIGHWAY ACCIDENT
                                                                                                                                                                                                  OLATION OF PIPING-SYSTEMS
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990000450 NT COMPONENTS- COLD-BOXES
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990003610 ESTS FOR CLASS-A CLEANING
990003620 EANLINESS (OXYGEN-CLEAN)
990003600 T FOR CLASS-B CLEANLINESS
99000360 RVICE VESSEL FABRICATION
990003680 D SURFACE HEAT-EXCHANGERS
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                           990001970 ETY- FIRE EXTINGUISHMENT 990000380 AIR-SEPARATION COLD-BOXES
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                                                               990003280 JELDS FOR DXYGEN SYSTEMS
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990001400 OBILE-DIE-105-HYDROCARBON
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990003700 GULERS FOR CXYGEN SERVICE
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990003640 ION AND TEST REGUIREMENTS
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1. Report N NASA C	o. R-120922 Vol. I	2. Government Accessi	on No.	3. Recipient's Catalog No.
4. Title and				5. Report Date
Liquid	Liquid and Gaseous Oxygen Safety Review			June 1972
Final Report, Vol. I to IV (1320 pages - 1			Total)	6. Performing Organization Code
7. Author(s) Abraham Lapin				8. Performing Organization Report No.
				APCI TM 184
Performing Organization Name and Address				10. Work Unit No.
Air Products and Chemicals, Inc.				11. Contract or Grant No.
P. O. Box 538 Allentown, Pennsylvania				NASA NO. NAS3-15083
Allent	own, Pennsylvania			13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address				Contractor Report
National Aeronautics and Space Administration				April 1971 - June 1972
Washin	Washington, D.C. 20546			14. Sponsoring Agency Code
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16. Abstract				
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